REPORT NUMBER: NCAP-MGA-2007-008

NEW CAR ASSESSMENT PROGRAM
FRONTAL BARRIER IMPACT TEST

DAIMLERCHRYSLER CORPORATION
2007 JEEP WRANGLER
NHTSA NUMBER: M70303

PREPARED BY:
MGA RESEARCH CORPORATION
5000 WARREN ROAD
BURLINGTON, WI 53105

Test Date: November 27, 2006

Final Report Date: December 28, 2006

FINAL REPORT

PREPARED FOR:
U.S. DEPARTMENT OF TRANSPORTATION
NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION
RULEMAKING
OFFICE OF CRASHWORTHINESS STANDARDS
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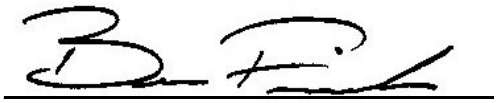
Prepared by:  Date: 12/28/06
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16. Abstract

A frontal barrier impact was conducted on a 2007 Jeep Wrangler at MGA Research Corporation on November 27, 2006. This test was conducted to obtain data indicant of FMVSS 208, 212, 219 (partial), 301, and foot well intrusion performance. The impact velocity was 56.5 km/h. The ambient temperature at the barrier face at the time of impact was 21 degrees Celsius. The vehicle's maximum post test static crush is 465 mm located to the right of the vehicle centerline. The test vehicle is equipped with a 3-point continuous belt system and an airbag in both front outboard seating positions. With respect to FMVSS 208 "Occupant Crash Protection", the occupant injury criteria summary is as follows:

Measurement Description	Units	Threshold	Driver ATD	Pass. ATD
Head Injury Criteria (HIC)	N/A	1000	551	452
Max. Thorax Accel. (3ms Clip)	G's	60	40	43
Left Femur Force	Newton	10009	-3084	-2386
Right Femur Force	Newton	10009	-6593	-2852

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SECTION 1

PURPOSE AND SUMMARY OF TEST

PURPOSE

This frontal barrier impact test is part of the Vehicle Barrier Impact Testing Program sponsored by the National Highway Traffic Safety Administration (NHTSA) under contract number DTNH22-06-D-00028. The purpose of this test was to obtain vehicle crashworthiness and occupant restraint system performance data for an impact in excess of the current 48.3 kph requirements.

SUMMARY

A load cell barrier was impacted by a 2007 Jeep Wrangler at a velocity of 56.5 kph. The test was performed at MGA Research Corporation on November 27, 2006. Pre-and post-test photographs of the vehicle and dummies can be found in Appendix A.

One real-time camera and fourteen high-speed cameras were used to document the frontal barrier impact event. Camera locations and other pertinent camera information can be found in this report.

Two Part 572E, 50th percentile male anthropomorphic test devices (ATDs), were placed in the driver and right-front passenger seating positions according to dummy placement instructions specified in the Laboratory Indicant Test Procedure.

Both ATDs were fully instrumented with head, chest and pelvis tri-axial accelerometers, chest displacement potentiometer, upper neck transducers, right/left femur load cells, and lower leg instrumentation. The driver (position 1) ATD (Serial No. 066) and right-front passenger (position 2) ATD (Serial No. 065) were calibrated previous to this test. Certification details, along with instrumentation calibration data, are found in Appendix C.

The 102 channels of data were recorded on an on-board data acquisition system. Appendix B contains the dummy head, chest, and femur response data traces.

There was 100 percent windshield retention and no intrusion into the protected zone of the windshield during the event. There was no Stoddard Solvent leakage after the event or during any phase of the static rollover.

The maximum static crush of the vehicle was 465 mm and both the driver and passenger side doors remained closed and latched during the impact event and were operable after the impact.

The driver's head and chest contacted the airbag. The driver's head also contacted the headrest. The driver's knees contacted the bolster. The passenger's head and chest contacted the airbag. The passenger's head also contacted the headrest. The passenger's knees contacted the glove box.

The occupant data is summarized below:

ATD position	HIC	T^1	T^2	Clip (g)	T^1	T^2	Chest Disp. (mm)	Left Femur (N)	Right Femur (N)
Driver	551	53.8	89.8	40	70.5	73.5	-29	-3084	-6593
Passenger	452	64.5	100.5	43	69.9	72.9	-30	-2386	-2852

The test data can be found on the NHTSA website at www.nhtsa.dot.gov.

TEST NOTES

None

SECTION 2

OCCUPANT AND VEHICLE INFORMATION / DATA SHEETS

DATA SHEET NO. 1

CRASH TEST SUMMARY

Test Vehicle: 2007 Jeep Wrangler
Test Program: 35mph Frontal Impact
NHTSA No.: M70303
Test Date: 11/27/2006

DOOR OPENING AND SEAT TRACK INFORMATION

Description	Driver	Passenger
Locked/Unlocked Doors	Doors were unlocked	Doors were unlocked
Front Door Opening	Door remained closed and latched; Door opened without tools	Door remained closed and latched; Door opened without tools
Rear Door Opening	Door remained closed and latched; Door opened without tools	Door remained closed and latched; Door opened without tools
Seat Track Shift (mm)	0	0
Seat Back Failure	None	None
Glazing Damage	The windshield cracked.	

VEHICLE REBOUND FROM BARRIER

Measured Parameter	Units	Value
Left Side	mm	768
Center	mm	745
Right Side	mm	795
Average	mm	769

BELT LENGTH DATA

Measurement Description	Units	Driver	Passenger
Shoulder belt length as measured on ATD	mm	823	806
Lap belt length as measured on ATD	mm	678	628
Remainder of belt on reel	mm	1549	1679
Total belt length for continuous webbing systems	mm	3050	3113

DATA SHEET NO. 2

GENERAL TEST AND VEHICLE PARAMETER DATA

Test Vehicle: 2007 Jeep Wrangler
Test Program: 35mph Frontal Impact

NHTSA No.: M70303
Test Date: 11/27/2006

TEST VEHICLE INFORMATION

Manufacturer	Jeep
Model	Wrangler
Body Style	SUV
NHTSA No.	M70303
VIN	1J4GA39157L110070
Color	Flame Red Clear Coat
Delivery Date	11/08/06
Odometer Reading (mile)	63
Dealer	Frank Boucher Jeep
Transmission	Manual Overdrive
Final Drive	4 Wheel
Number of Cylinders	6
Engine Displacement (L)	3.8
Engine Placement	Longitudinal
Automatic Door Lock (ADL)	No
Owners Manual Details Instructions on Disabling ADLs	N/A
Bucket Seats	Yes

TEST VEHICLE OPTIONS

Front Airbag	Yes
Driver Side Curtain Airbag	No
Driver Side Torso Airbag	No
Rear Passenger Side Curtain Airbag	No
Rear Passenger Side Torso Airbag	No
Force Limiter	Yes
Pretensioner	Yes
Power Steering	Yes
Power Door Locks	No
Tilt Wheel	Yes
Air Conditioning	Yes
Anti-lock Brakes	Yes
Traction Control	Yes
All Wheel Drive	Yes
Power Seats	No

DATA FROM CERTIFICATION LABEL

Manufactured By	DaimlerChrysler Corporation
Date of Manufacture	10-06

GVWR (kg)	2450
GAWR Front (kg)	1203
GAWR Rear (kg)	1361

Measured Parameter	Front	Rear	Third	Total
Type of Seats	Bucket	Split Bench		
Number of Occupants	2	3		5
Capacity Wt. (VCW) (kg)				385
Cargo Wt. (RCLW) (kg)				45

DATA SHEET NO. 2... (CONTINUED)

GENERAL TEST AND VEHICLE PARAMETER DATA

Test Vehicle: 2007 Jeep Wrangler
Test Program: 35mph Frontal Impact
NHTSA No.: M70303
Test Date: 11/27/2006

TEST VEHICLE WEIGHTS

	Units	As Delivered (UVW) (Axle)			As Tested (ATW) (Axle)		
		Front	Rear	Total	Front	Rear	Total
Left	kg	492.1	474.0		527.1	532.0	
Right	kg	512.6	478.5		550.2	543.0	
Ratio	%	51.3	48.7		50.0	50.0	
Totals	kg	1004.7	952.5	1957.2	1077.3	1075.0	2152.3

TARGET TEST WEIGHT CALCULATION

Measured Parameter	Units	Value
Total Delivered Weight (UVW)	kg	1957.2
Weight of 2 P572E ATDs	kg	156.0
Rated Cargo/Luggage Weight (RCLW)	kg	45
Calculated Vehicle Target Weight (TVTW)	kg	2158.2

TEST VEHICLE ATTITUDES AND CG

	Units	LF	RF	LR	RR	CG (aft of front axle)
As Delivered	mm	882	880	889	895	1436
As Tested	mm	869	861	866	860	1474
Post Test	mm	854	857	876	862	

Vehicle Wheelbase (mm): 2951

Weight of Ballast secured in cargo area (kg): 0

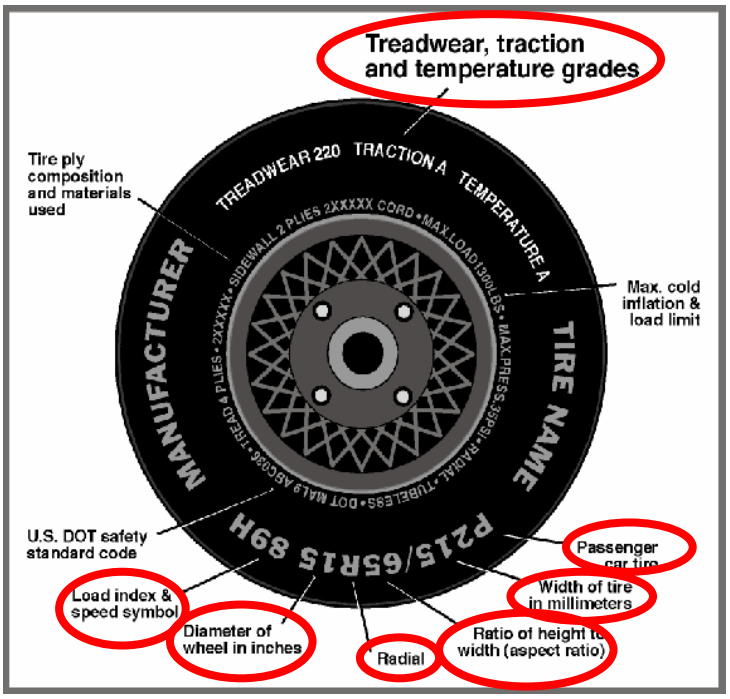
Vehicle Components Removed: Jack & tools, right tail light, trunk carpet

Ballast weight does not include instrumentation and data acquisition system.

DATA SHEET NO. 3

TEST VEHICLE TIRE INFORMATION

Test Vehicle: 2007 Jeep Wrangler NHTSA No.: M70303
Test Program: 35mph Frontal Impact Test Date: 11/27/2006



DATA FROM TIRE PLACARD

Measured Parameter	Front	Rear
Maximum Tire Pressure (kPa)	300	300
Cold Pressure (kPa)	240	240
Recommended Tire Size	P225/75R16	P225/75R16
Tire Size on Vehicle	P225/75R16	P225/75R16
Tire Manufacturer	Goodyear	Goodyear
Tire Name	Wrangler ST	Wrangler ST
Tire Type	Passenger	Passenger
Tire Width (mm)	225	225
Ratio of Height to Width (aspect ratio)	75	75
Radial	R	R
Wheel Diameter	16	16
Load Index & Speed Symbol	104S	104S
Treadwear	340	340
Traction Grade	B	B
Temperature Grade	B	B

DATA SHEET NO. 4

TEST VEHICLE INFORMATION

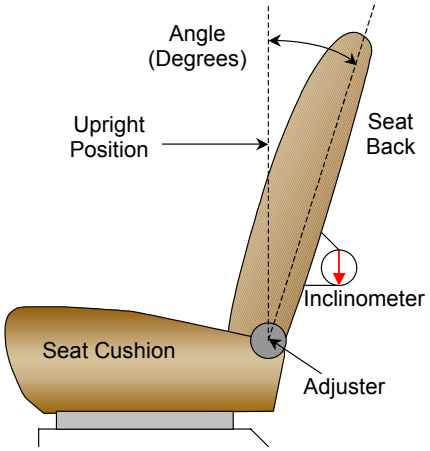
Test Vehicle: 2007 Jeep Wrangler NHTSA No.: M70303
Test Program: 35mph Frontal Impact Test Date: 11/27/2006

NORMAL DESIGN RIDING POSITION

The driver and passenger seat back is positioned to the manufacturer's designated angle. The procedure is as follows: Test position measured from upright position is 16 degrees at the headrest rods.

Driver seat back angle: 16.1° at the headrest post

Passenger seat back angle: 16.1° at the headrest post



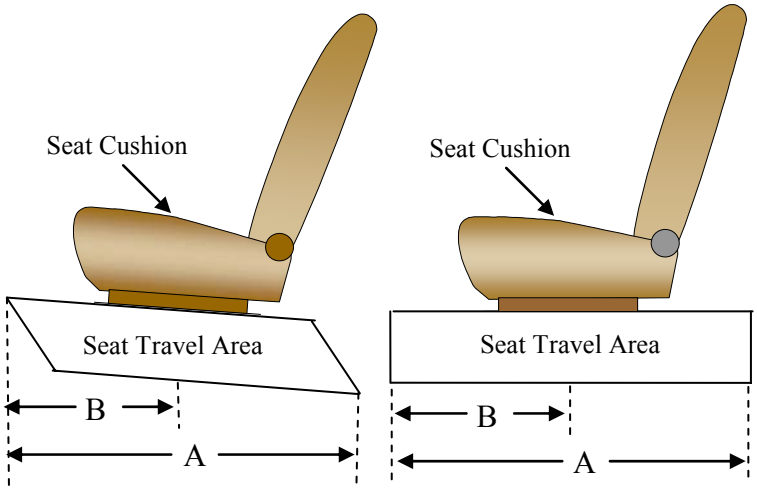
FRONT SEAT ASSEMBLY

SEAT FORE/AFT POSITIONING

	Total Fore/Aft Travel	Placed in Position #
Driver Seat	23 detents	11th detent, 1st as 0
Passenger Seat	24 detents	12th detent, 1st as 0

ADJUSTABLE D-RING POSITION

The driver and passenger D-rings were placed in the mid position.



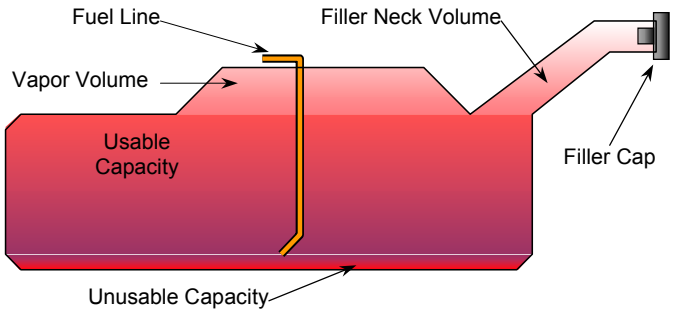
DATA SHEET NO. 4…(CONTINUED)
TEST VEHICLE INFORMATION

Test Vehicle: 2007 Jeep Wrangler NHTSA No.: M70303
Test Program: 35mph Frontal Impact Test Date: 11/27/2006

FUEL TANK CAPACITY

	Liters
Usable Capacity of "Standard Tank"	85.2
Usable Capacity of "Optional" Tank	
92-94% of Usable Capacity	78.4 – 80.1
Actual Amount of Solvent used	79.5
1/3 of Usable Capacity	28.4

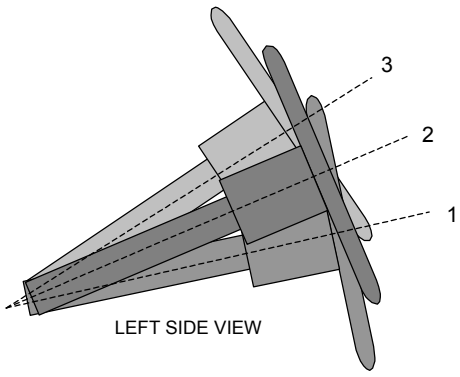
The test vehicle is equipped with an electric fuel pump. The fuel pump will pump fuel when the ignition is keyed on for approximately 2-3 seconds to prime the system and then shut off. Once the vehicle is started the pump runs continuously until the vehicle is shut off. The engine controller has the ability to sense if the vehicle is in an impact condition and the engine controller will automatically shut-off the fuel pump if such an event has occurred.



VEHICLE FUEL TANK ASSEMBLY

STEERING COLUMN ADJUSTMENT

Steering wheel and column adjustments are made so that the steering wheel hub is at the geometric center of the locus it describes when moved through its full range of motion. An aluminum plate is placed across the rim of the steering wheel, an inclinometer is placed on the plate and the angle is measured.



STEERING COLUMN ASSEMBLY

STEERING COLUMN POSITIONS

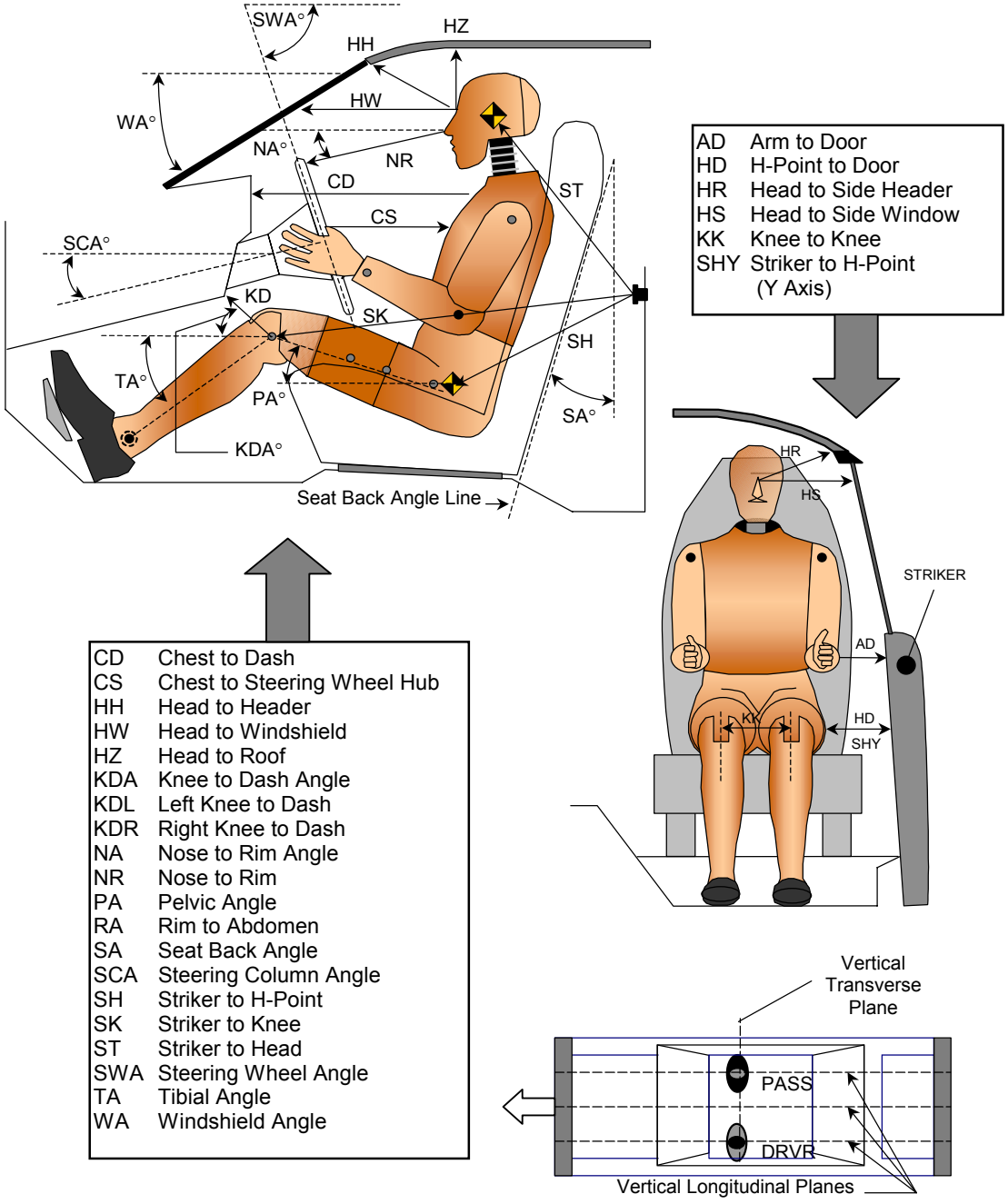
	Fore/Aft Position (mm)	Degrees
Lowermost position No. 1		18.5
Geometric center position No. 2		21.4
Uppermost position No. 3		24.3

DATA SHEET NO. 5

DUMMY POSITIONING IN VEHICLE

Test Vehicle:	2007 Jeep Wrangler	NHTSA No.:	M70303
Test Program:	35mph Frontal Impact	Test Date:	11/27/2006

DUMMY MEASUREMENTS FOR FRONT SEAT OCCUPANTS



DATA SHEET NO. 5... (CONTINUED)

DUMMY POSITIONING IN VEHICLE

Test Vehicle: 2007 Jeep Wrangler NHTSA No.: M70303
Test Program: 35mph Frontal Impact Test Date: 11/27/2006

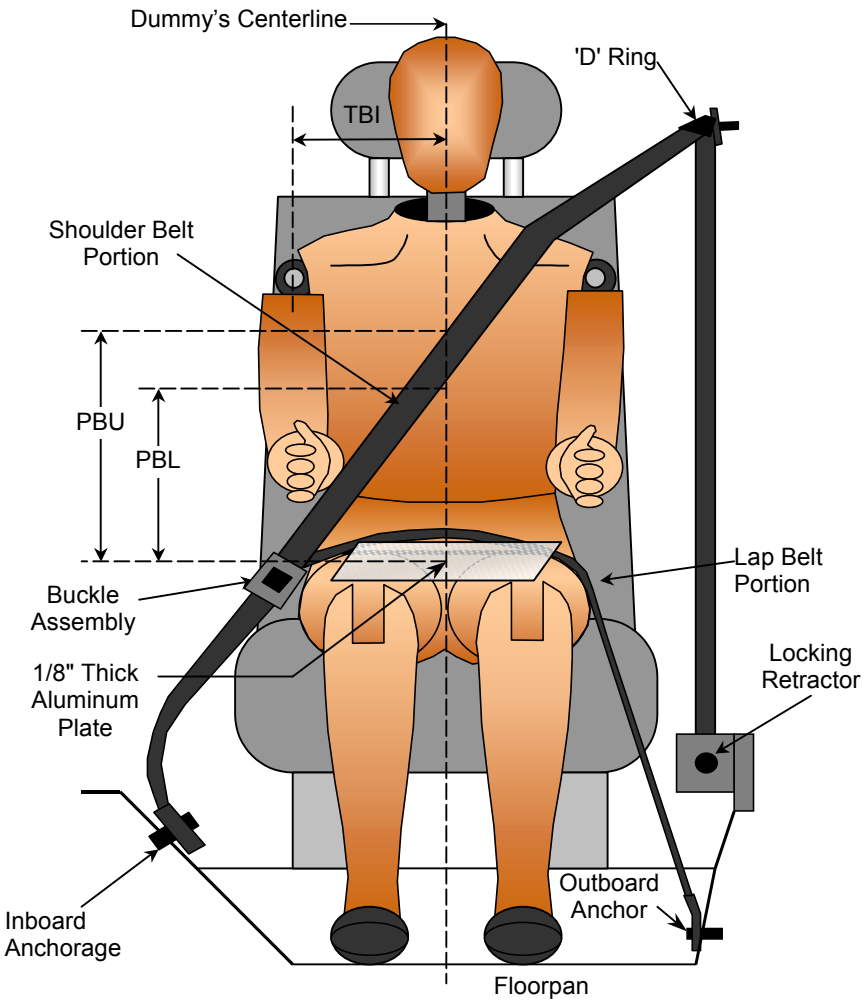
TEST DUMMY POSITION MEASUREMENTS

Code	Measurement Description	Driver		Passenger	
		Length (mm)	Angle (°)	Length (mm)	Angle (°)
WA	Windshield Angle		61.3		
SWA	Steering Wheel Angle		68.6		
SCA	Steering Column Angle		21.4		
SA	Seat Back Angle (headrest post)		16.1		16.1
HZ	Head to Roof (Z)	248	90	238	90
HH	Head to Header	575	11.4	577	12.6
HW	Head to Windshield	628	0	632	0
HR	Head to Side Header (Y)	223		219	
NR	Nose to Rim	371	13.8		
CD	Chest to Dash	484		451	
CS	Chest to Steering Hub	299	8.9		
RA	Rim to Abdomen	172	0		
KDL	Left Knee to Dash	138	14.7	149	
KDR	Right Knee to Dash	122		151	24.6
PA	Pelvic Angle		24.2		20.6
TA	Tibia Angle		52.4		53.7
KK	Knee to Knee (Y)	285		236	
SK	Striker to Knee	612	83.9	608	86.6
ST	Striker to Head	590	6.5	610	9.1
SH	Striker to H-Point	208	99.8	206	104.3
SHY	Striker to H-Point (Y)	188		183	
HS	Head to Side Window	344		357	
HD	H-Point to Door (Y)	128		125	
AD	Arm to Door (Y)	86		77	
AA	Ankle to Ankle	265		149	

DATA SHEET NO. 6

SEAT BELT POSITIONING DATA

Test Vehicle: 2007 Jeep Wrangler
Test Program: 35mph Frontal Impact
NHTSA No.: M70303
Test Date: 11/27/2006



SEAT BELT POSITIONING MEASUREMENTS

Measurement Description	Units	Driver	Passenger
PBU - Top surface of reference to belt upper edge	mm	340	340
PBL - To surface of reference to belt lower edge	mm	280	280

DATA SHEET NO. 7

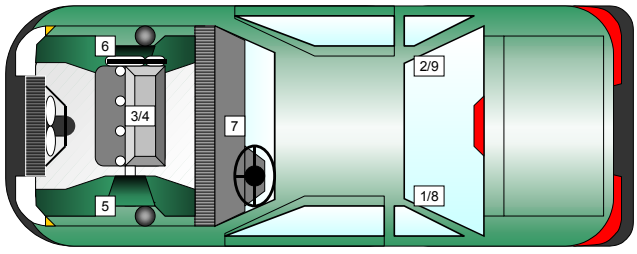
VEHICLE ACCELEROMETER LOCATIONS

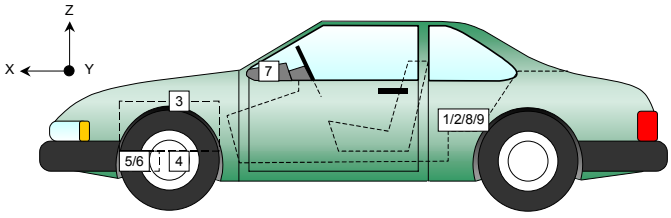
Test Vehicle: 2007 Jeep Wrangler
Test Program: 35mph Frontal Impact
NHTSA No.: M70303
Test Date: 11/27/2006

VEHICLE ACCELEROMETER PRE-TEST LOCATIONS

No.	Accelerometer Location	Measurements (mm)		
		X	Y	Z
1	Left Rear X-Member X	1595	-368	550
2	Right Rear X-Member X	1573	348	550
3	Engine Top X	3426	35	1128
4	Engine Bottom X	3589	0	310
5	Left Brake Caliper X	3609	-657	346
6	Right Brake Caliper X	3609	657	346
7	Instrument Panel X			
8	Left Rear X-Member Z	1595	-368	550
9	Right Rear X-Member Z	1573	348	550

Reference Points: X - Rear Surface of Vehicle (+ forward)
Y - Vehicle Centerline (+ to right)
Z - Ground Plane (+ up)





DATA SHEET NO. 8

SUMMARY OF FMVSS 212 AND FMVSS 219 (Partial) DATA

Test Vehicle: 2007 Jeep Wrangler NHTSA No.: M70303
Test Program: 35mph Frontal Impact Test Date: 11/27/2006

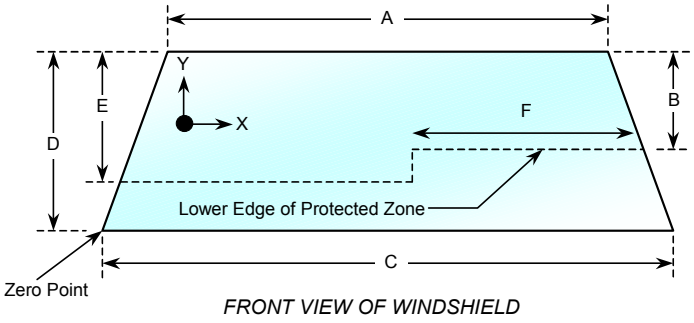
Windshield Mounting Details:
Windshield glass is secured to the vehicle frame with a rubber trim and glue.

The standard requires that the post-test retention measurement be a minimum of 75 percent of the pretest total periphery measurement for vehicles not equipped with occupant passive restraints and 50 percent for each side of the windshield for vehicles, which are equipped with occupant passive restraints.

Temperature of windshield molding during test: 21°C

WINDSHIELD PERIPHERY MEASUREMENTS

Measurement	Pre-Test (mm)	Post-Test (mm)	% of Retention
Left Side	1832	1832	100
Right Side	1832	1832	100
Total	3664	3664	100



FRONT VIEW OF WINDSHIELD

Item	Units	Value
A	mm	1300
B	mm	243
C	mm	1424
D	mm	470
E	mm	278
F	mm	478

AREA OF PROTECTED ZONE FAILURES - NONE

A. Provide coordinates of the area that the protected zone was penetrated more than 0.25 inches by a vehicle component other than one that is normally in contact with the windshield. **None**

X	Y

B. Provide coordinates of the area beneath the protected zone that the inner surface of the windshield was penetrated by a vehicle component. **None**

X	Y

DATA SHEET NO. 9

SUMMARY OF FMVSS 301 DATA

Test Vehicle: 2007 Jeep Wrangler NHTSA No.: M70303
Test Program: 35mph Frontal Impact Test Date: 11/27/2006

FMVSS 301 FUEL SYSTEM INTEGRITY POST IMPACT DATA

Temperature at Time of Impact: 21° C Test Time: 10:10 am

Stoddard Solvent Spillage Measurements

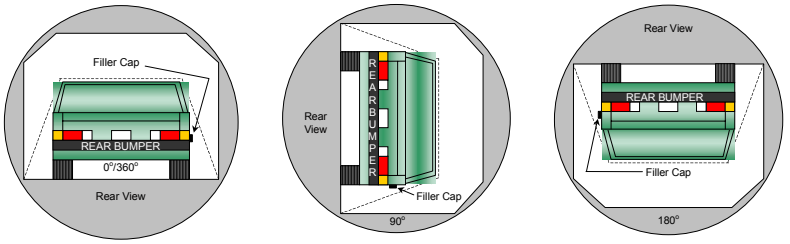
A. From impact until vehicle motion ceases: 0 oz.
(Maximum Allowable = 1 ounce)

B. For the 5 minute period after motion ceases: 0 oz.
(Maximum Allowable = 5 ounces)

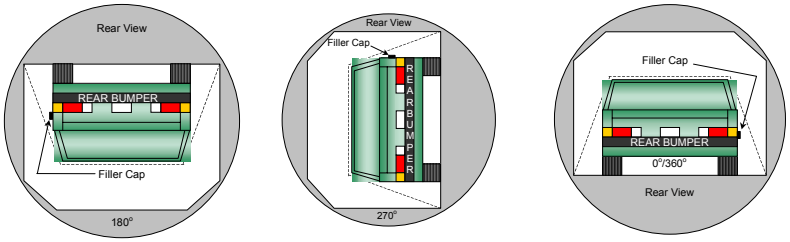
C. For the following 25 minutes: 0 oz.
(Maximum Allowable = 1 oz. /minute)

D. Spillage: None

FMVSS 301 STATIC ROLLOVER DATA



0° to 90° 90° to 180°



180° to 270° 270° to 360°

1. The specified fixture rollover rate for each 90° of rotation is 60 to 180 seconds.

2. The position hold time at each position is 300 seconds (minimum).

3. Details of Stoddard Solvent spillage locations: **None**

Test Phase	Rotation Time (sec.)	Hold Time (sec.)	Spillage (oz.)
0° to 90°	123	300	0
90° to 180°	121	300	0
180° to 270°	117	300	0
270° to 360°	115	300	0

DATA SHEET NO. 10

VEHICLE MEASUREMENTS

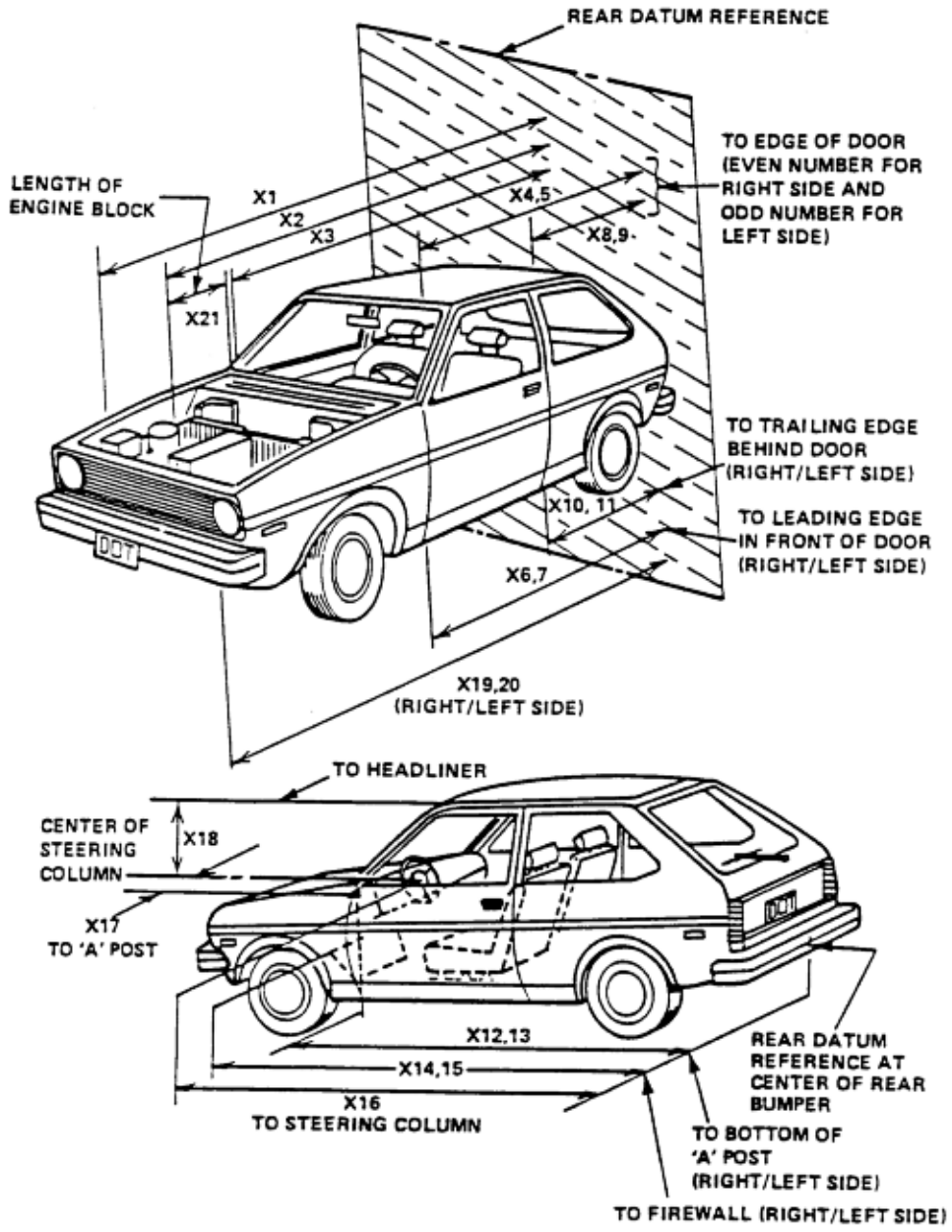
Test Vehicle: 2007 Jeep Wrangler
Test Program: 35mph Frontal Impact
NHTSA No.: M70303
Test Date: 11/27/2006

No.	Measurement Description	Units	Pre-Test	Post-Test	Difference
1	Total length of vehicle at centerline	mm	4454	4003	451
2	RSOV to front of engine	mm	3716	3660	56
3	RSOV to firewall centerline	mm	3219	3182	37
4	RSOV to leading edge of right door	mm	2855	2903	-48
5	RSOV to leading edge of left door	mm	2861	2906	-45
6	RSOV to lower leading edge of right door	mm	2870	2881	-11
7	RSOV to lower leading edge of left door	mm	2872	2883	-11
8	RSOV to upper leading edge of right door	mm	1945	1999	-54
9	RSOV to upper leading edge of left door	mm	1948	2011	-63
10	RSOV to lower trailing edge of right door	mm	2061	2070	-9
11	RSOV to lower trailing edge of left door	mm	2054	2062	-8
12	RSOV to bottom of right 'A' pillar	mm	2873	2868	5
13	RSOV to bottom of left 'A' pillar	mm	2876	2876	0
14	RSOV to firewall on right side	mm	3241	3243	-2
15	RSOV to firewall on left side	mm	3248	3248	0
16	RSOV to steering column	mm	2541	2597	-56
17	Center of steering column to left 'A' pillar	mm	451	442	9
18	Center of steering column to headlining	mm	484	482	2
19	RSOV to right side of front bumper	mm	4373	3949	424
20	RSOV to left side of front bumper	mm	4361	3964	397
21	Length of engine block	mm	425	425	0
RD	RSOV to right side of dash panel	mm	2685	2716	-31
CD	RSOV to center of dash panel	mm	2628	2654	-26
LD	RSOV to left side of dash panel	mm	2696	2712	-16

DATA SHEET NO. 10... (continued)

VEHICLE MEASUREMENTS

Test Vehicle:	2007 Jeep Wrangler	NHTSA No.:	M70303
Test Program:	35mph Frontal Impact	Test Date:	11/27/2006



DATA SHEET NO. 10... (continued)

VEHICLE MEASUREMENTS

Test Vehicle: 2007 Jeep Wrangler NHTSA No.: M70303
Test Program: 35mph Frontal Impact Test Date: 11/27/2006

Target Vehicle Structural Measurement

	Elements	Pre-Test (mm)
1	Total Length	4454
2	Total Width	1644
3	Bumper Top Height	668
4	Bumper Bottom Height	475
5	Longitudinal Member Top Height	608
6	Distance between Longitudinal Members	829
7	Longitudinal Member Width	61
8	Engine Top Height	1120
9	Engine Bottom Height	312
10	Engine and gearbox width	615
11	Front bumper-engine distance	785
12	Front shock absorber fixing height	820
13	Bonnet leading edge height	1086
14	Front shock absorber fixing width	884
15	Front bumper – front axle distance	729
16	Front axle – a pillar distance	877
17	A-pillar – B-pillar distance	963
18	B-Pillar – rear axle distance	1100
19	B-pillar – C-pillar distance	780
20	Roof sill bottom height	1690
21	Roof sill top height	1725
22	Floor sill bottom height	445
23	Floor sill top height	535

DATA SHEET NO. 11

CAMERA LOCATIONS

Test Vehicle: 2007 Jeep Wrangler NHTSA No.: M70303
Test Program: 35mph Frontal Impact Test Date: 11/27/2006

No.	Camera View	Location (mm) *			Lens (mm)	Speed (fps)
		X	Y	Z		
1	Real-Time Left Side View				13	24
2	Left Front View	1000	-5100	1310	24	1000
3	Steering Column Top	1630	-5240	1300	25	1000
4	Steering Column Bottom	1630	-5230	910	25	1000
5	Driver Close-up	1530	-6370	1555	35	1000
6	Driver Angle	6030	-5360	2060	50	1000
7	On board Driver Side					
8	On board Passenger Side					
9	Right Overall	2000	6270	1330	19	1000
10	Right Passenger Half	1280	5890	1280	25	1000
11	Right Close-up	1630	6140	1600	35	1000
12	Right Angle	6020	5200	2050	50	1000
13	Windshield	-285	0	2830	19	1000
14	Top Driver	-155	-375	2250	24	1000
15	Top Passenger	-150	505	2240	24	1000
16	Pit Front	1085	0	-3150	24	1000
17	Pit Rear	3215	0	-3150	24	1000

*COORDINATES:

+X = forward of impact plane
+Y = right of monorail centerline
+Z = above ground level

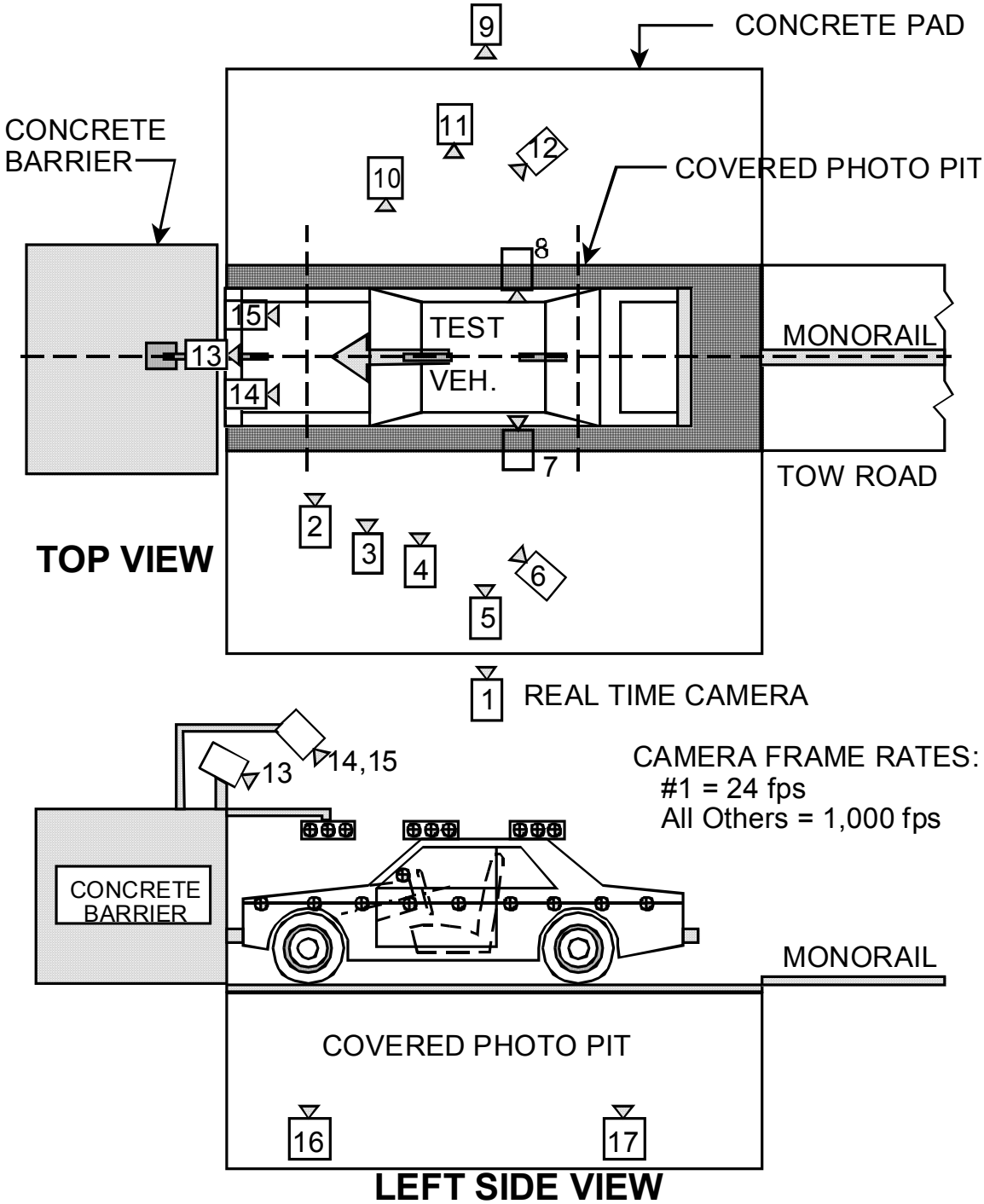
Note: Cameras 7 and 8 were not used for this test.

DATA SHEET NO. 11... (continued)

CAMERA LOCATIONS

Test Vehicle:	2007 Jeep Wrangler	NHTSA No.:	M70303
Test Program:	35mph Frontal Impact	Test Date:	11/27/2006

CAMERA POSITIONS FOR FRONTAL IMPACTS



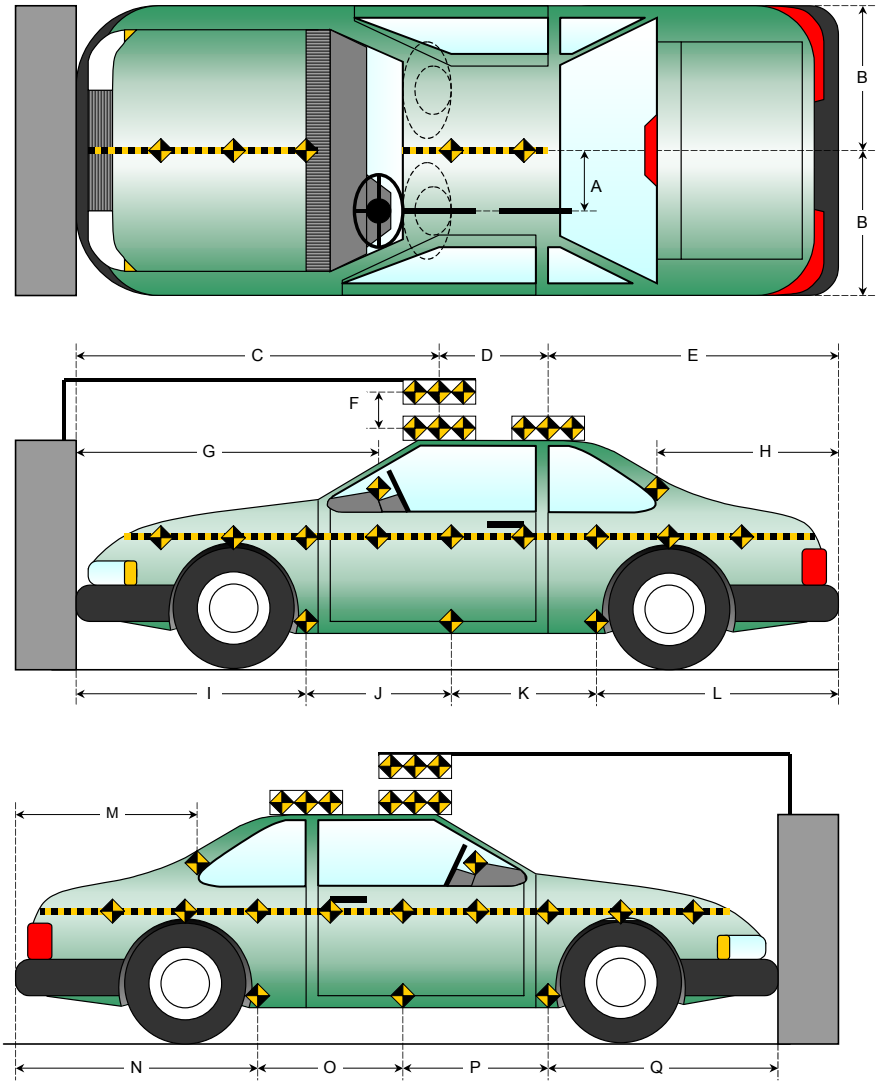
DATA SHEET NO. 12

PHOTOGRAPHIC REFERENCE TARGET LOCATIONS

Test Vehicle: 2007 Jeep Wrangler
Test Program: 35mph Frontal Impact

NHTSA No.: M70303
Test Date: 11/27/2006

Item	Value
A	406
B	822
C	2436
D	611
E	1407
F	1796
G	
H	1105
I	1295
J	901
K	901
L	1357
M	1106
N	1351
O	904
P	904
Q	1295



DATA SHEET NO. 13

VEHICLE INTRUSION MEASUREMENTS

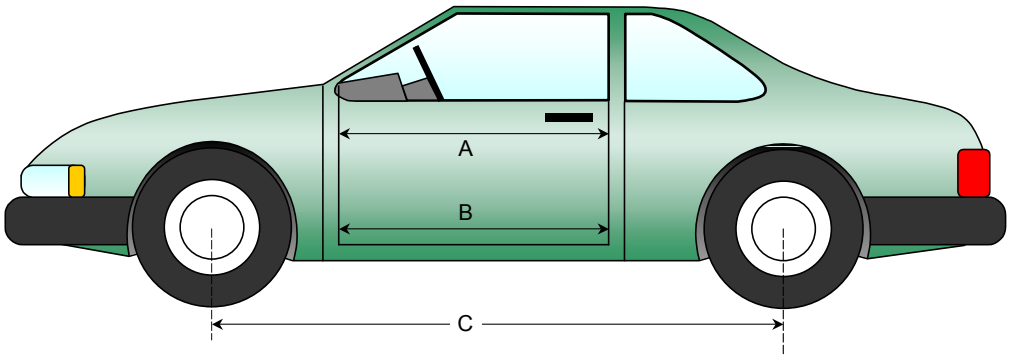
Test Vehicle: 2007 Jeep Wrangler
Test Program: 35mph Frontal Impact
NHTSA No.: M70303
Test Date: 11/27/2006

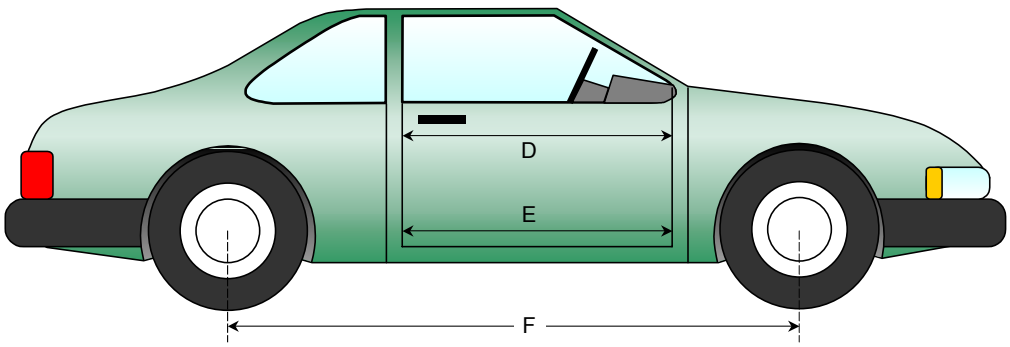
DOOR OPENING WIDTH

Item	Description	Units	Pre-Test	Post-Test	Difference
A	Left Side Upper	mm	908	877	31
B	Left Side Lower	mm	881	870	11
D	Right Side Upper	mm	909	878	31
E	Right Side Lower	mm	882	867	15

WHEELBASE MEASUREMENTS

Item	Description	Units	Pre-Test	Post-Test	Difference
C	Left Side Wheelbase	mm	2948	2863	85
F	Right Side Wheelbase	mm	2946	2859	87





DATA SHEET NO. 13... (continued)

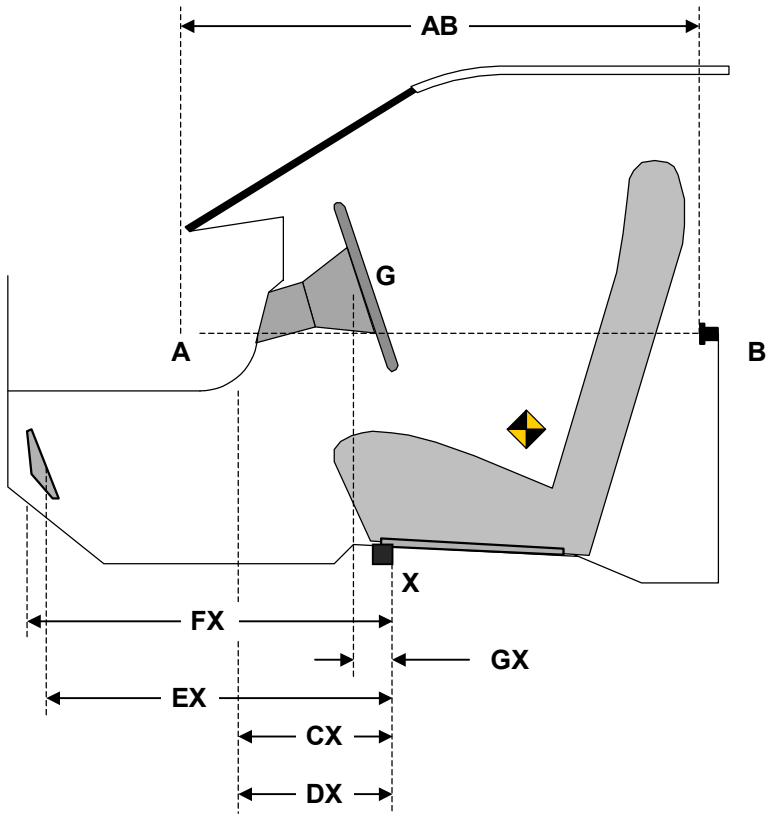
VEHICLE INTRUSION MEASUREMENTS

Test Vehicle: 2007 Jeep Wrangler NHTSA No.: M70303
Test Program: 35mph Frontal Impact Test Date: 11/27/2006

DRIVER COMPARTMENT INTRUSION

Item	Description	Units	Pre-Test	Post-Test	Difference
AB	Door Opening (Inside window jam)	mm	696	692	4
CX	Left Knee Bolster to X	mm	285	307	-22
DX	Right Knee Bolster to X	mm	301	305	-4
EX	Brake Pedal to X	mm	495	478	17
FX	Foot Rest to X	mm			
GX	Center of Steering Column Wheel Hub to X	mm	15	61	-46

X = Front of Seat Track (stationary)

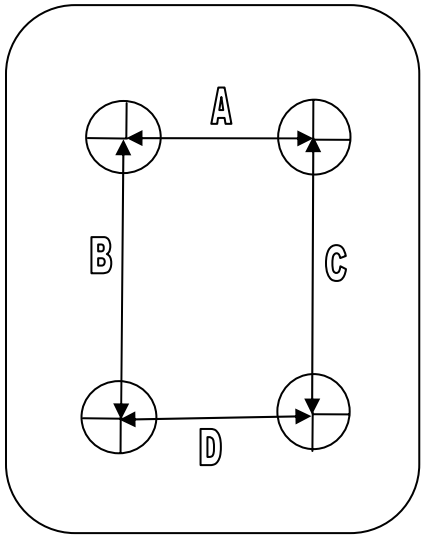


DRIVER COMPARTMENT

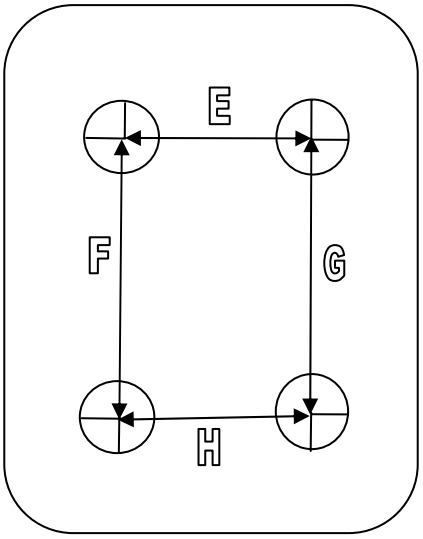
DATA SHEET NO. 13... (continued)

VEHICLE INTRUSION MEASUREMENTS

Test Vehicle: 2007 Jeep Wrangler NHTSA No.: M70303
Test Program: 35mph Frontal Impact Test Date: 11/27/2006



Driver



Passenger

UNDERBODY FLOORBOARD DEFORMATION

Measurement	Pre-Test	Post-Test	Difference
A	148	148	0
B	198	191	7
C	190	179	11
D	185	185	0
E	138	138	0
F	200	188	12
G	203	196	7
H	158	154	4

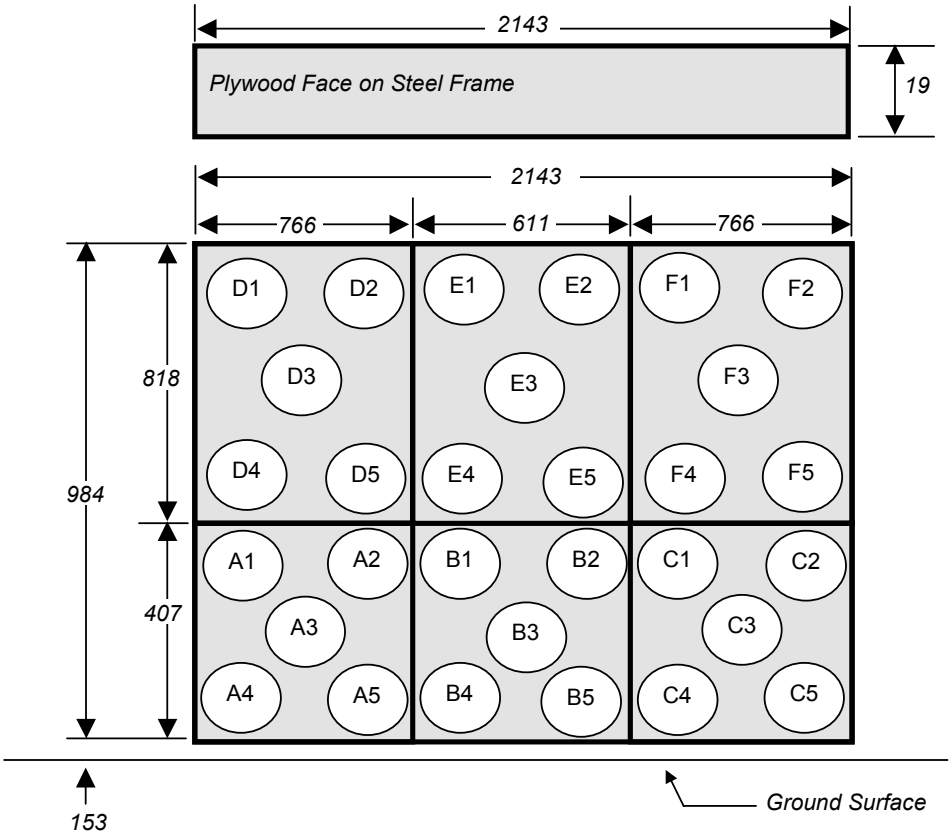
DATA SHEET NO. 14

LOAD CELL LOCATIONS ON FIXED BARRIER

Test Vehicle: 2007 Jeep Wrangler NHTSA No.: M70303
Test Program: 35mph Frontal Impact Test Date: 11/27/2006

30 Load Cell Rigid Barrier

Load Cell Locations on Fixed Barrier



Group 4 D1-D5	Group 5 E1-E5	Group 6 F1-F5
Group 1 A1-A5	Group 2 B1-B5	Group 3 C1-C5

6 Groups of 5 Load Cells Each

DATA SHEET NO. 15

ACCIDENT INVESTIGATION DIVISION DATA

Test Vehicle: 2007 Jeep Wrangler NHTSA No.: M70303
Test Program: 35mph Frontal Impact Test Date: 11/27/2006

VEHICLE INFORMATION

VIN: 1J4GA39157L110070 Wheelbase (mm) : 2951
Vehicle Size Category: SUV Test Weight (kg) : 2152.3

ACCELEROMETER DATA

Accelerometer Locations: As per measurements on Page 12
Cal. Procedure/Interval: MGA procedure / 6 month
Integration Algorithm: Trapezoidal Linearity: > 99%
Impact Velocity (km/h): 56.5
Velocity Change (km/h): 64.0 Time of Separation (msec): 109

CRUSH PROFILE

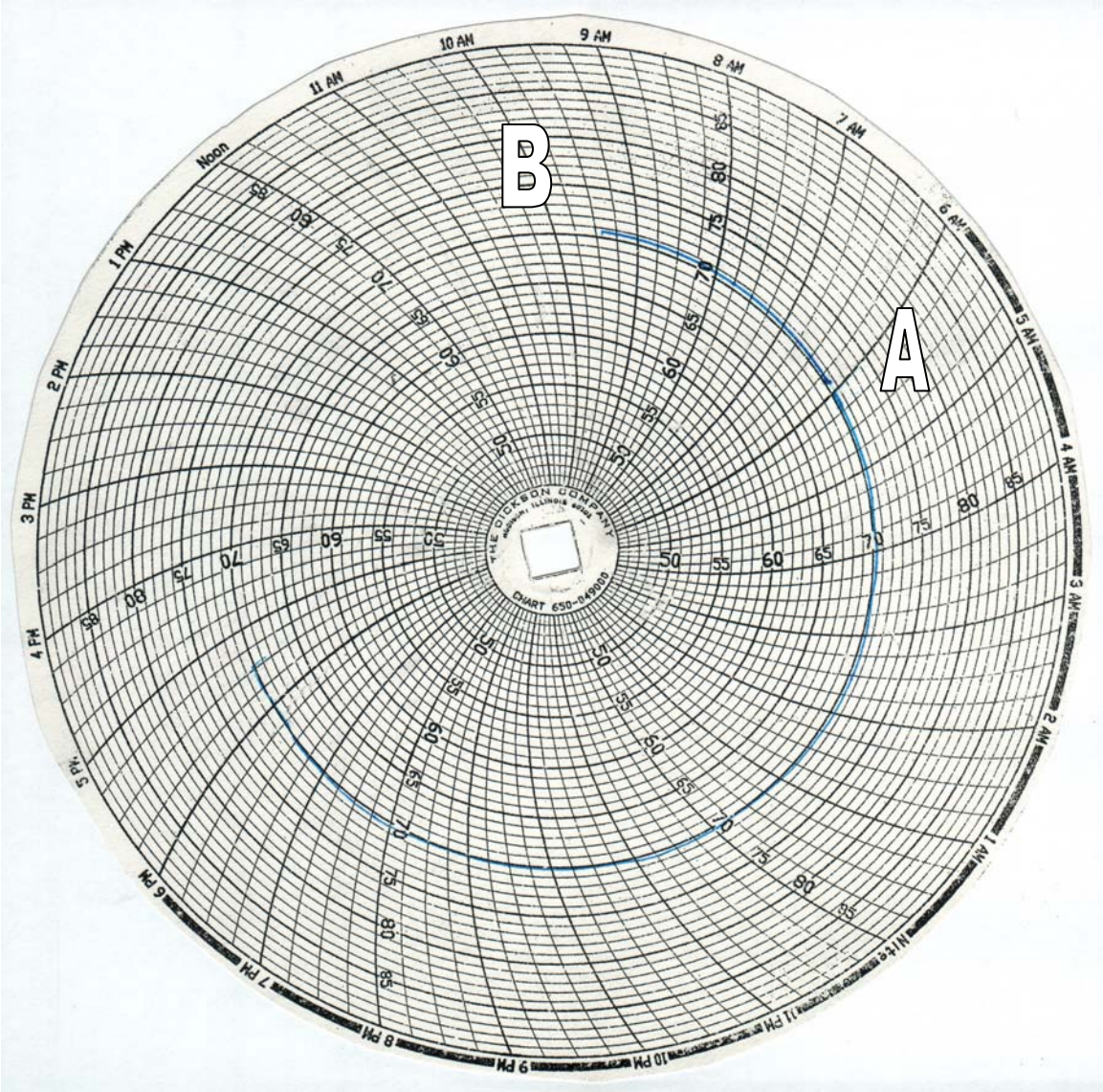
Collision Deformation Classification: Frontal Midpoint of Damage: Centerline
Damage Region Length (mm): 1700 Impact Mode: Frontal

No.	Measurement Description	Units	Pre-Test	Post-Test	Difference
C1	Crush zone 1 at left side	mm	4361	3964	397
C2	Crush zone 2 at left side	mm	4433	4004	429
C3	Crush zone 3 at left side	mm	4449	4000	449
C4	Crush zone 4 at right side	mm	4454	3989	465
C5	Crush zone 5 at right side	mm	4431	3984	447
C6	Crush zone 6 at right side	mm	4373	3949	424
L	C1 TO C6	mm	1700	1674	26

DATA SHEET NO. 16

DUMMY / VEHICLE TEMPERATURE STABILIZATION CHART

Test Vehicle:	2007 Jeep Wrangler	NHTSA No.:	M70303
Test Program:	35mph Frontal Impact	Test Date:	11/27/2006



A = Dummies installed in vehicle at 6:00 am

B = Test conducted at 10:10 am

APPENDIX A

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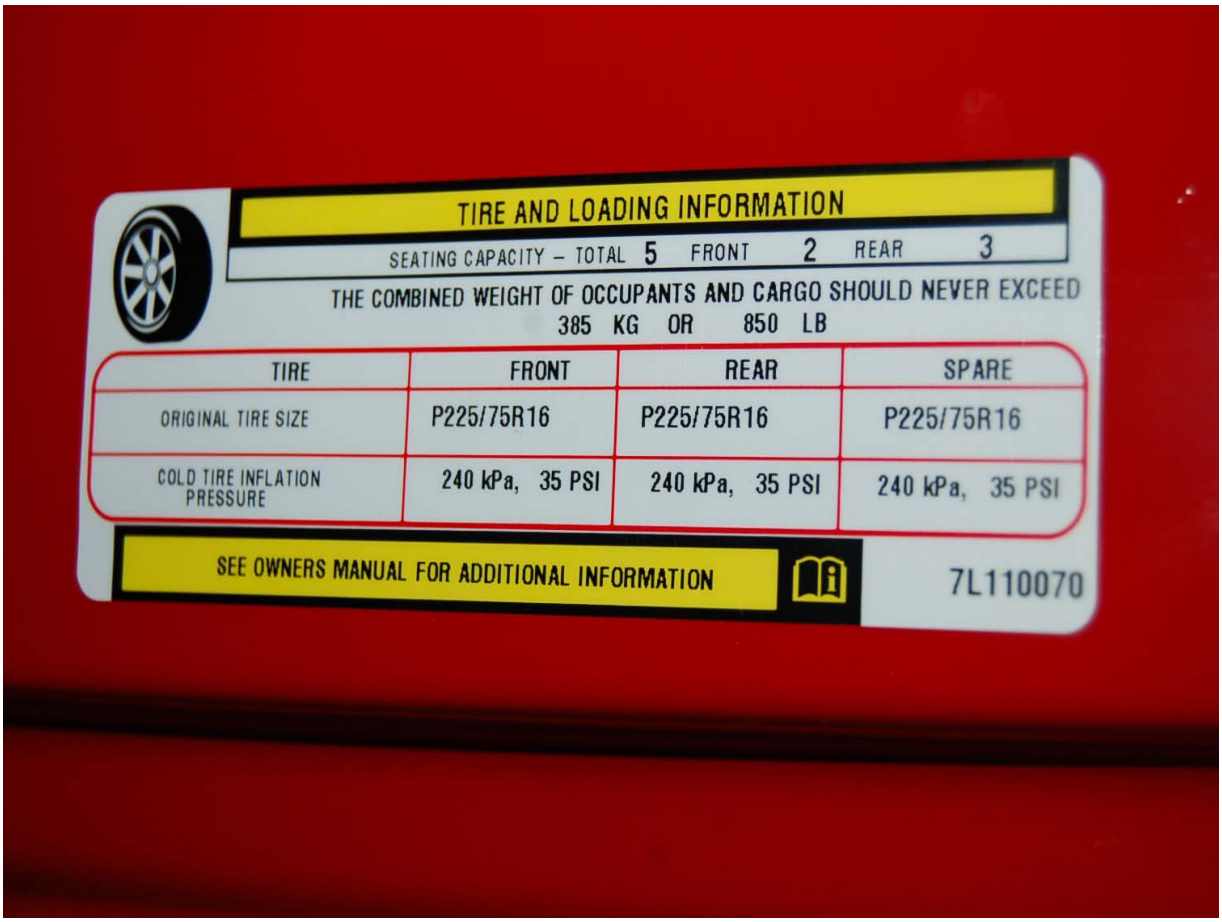
Load Cell Location

Manufacturer's Label



Tire Placard

Left Front ¾ View, As Received

Right Rear ¾ View, As Received

Pre-Test Front View

Post-Test Front View

Pre-Test Left Side View

Post-Test Left Side View

Pre-Test Right Side View

Post-Test Right Side View

Pre-Test Right Front ¾ View

Post-Test Right Front ¾ View

Pre-Test Left Rear ¾ View

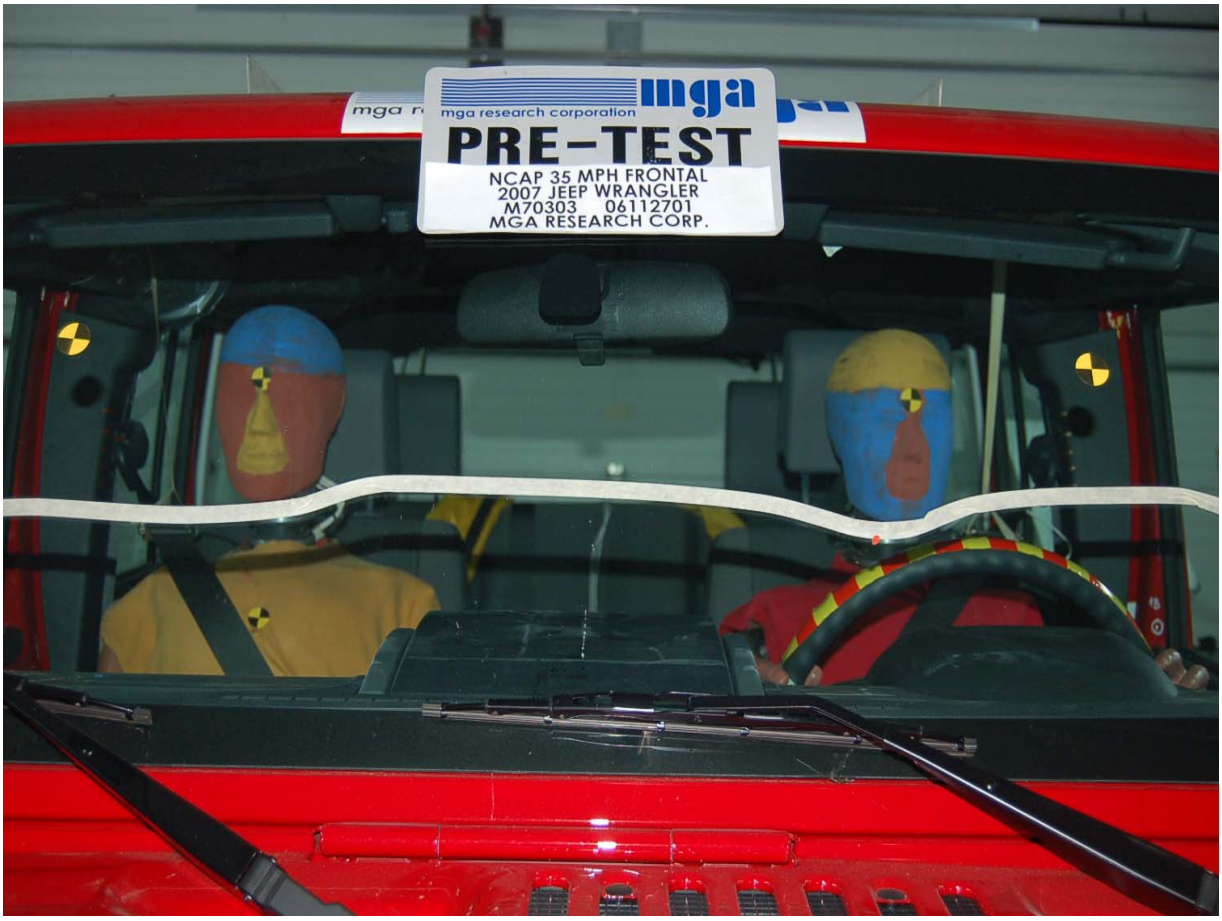
Post-Test Left Rear ¾ View

Pre-Test Left Side ¾ View of Doors

Post-Test Left Side ¾ View of Doors After Impact

Pre-Test Right Side ¾ View of Doors

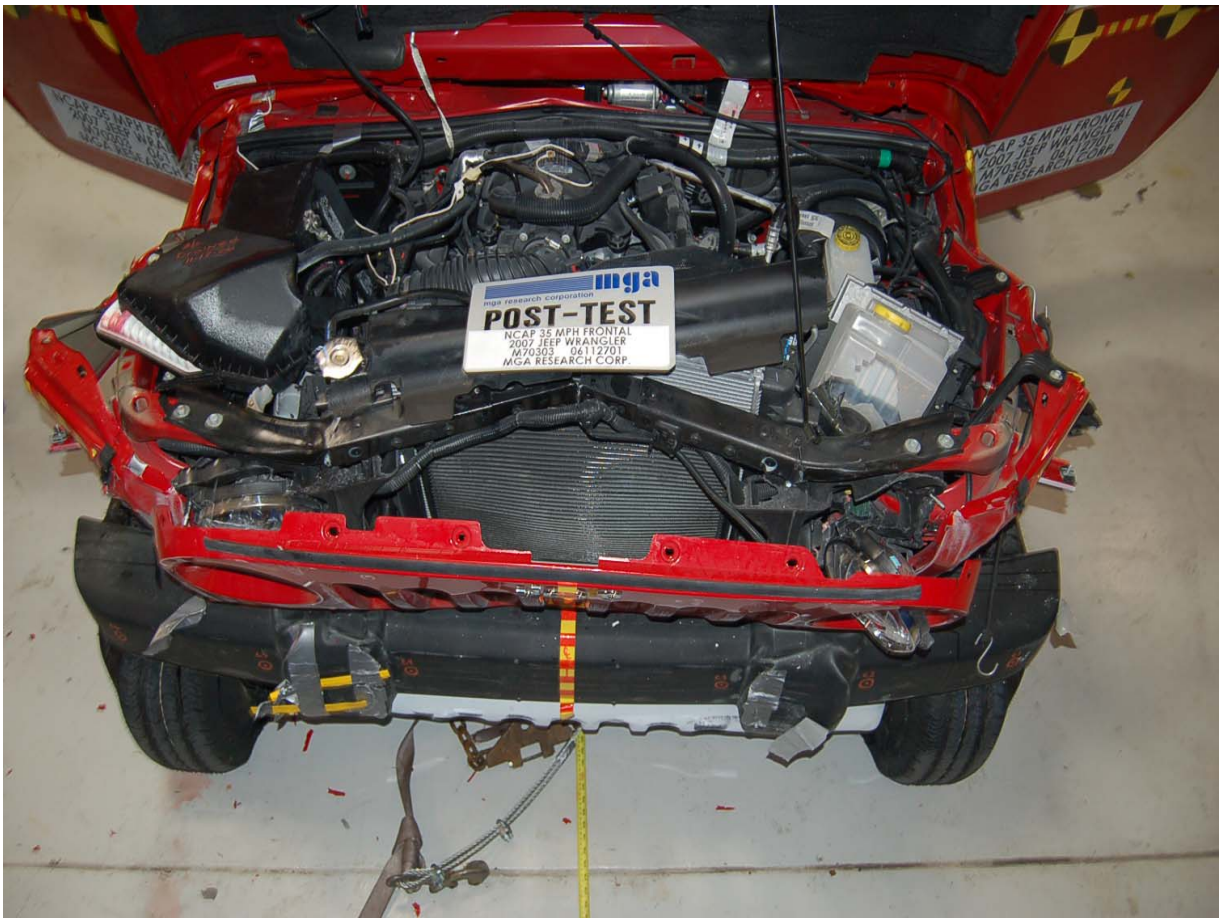
Post-Test Right Side ¾ View of Doors After Impact



Pre-Test Windshield View

Post-Test Windshield View

Pre-Test Engine Compartment View

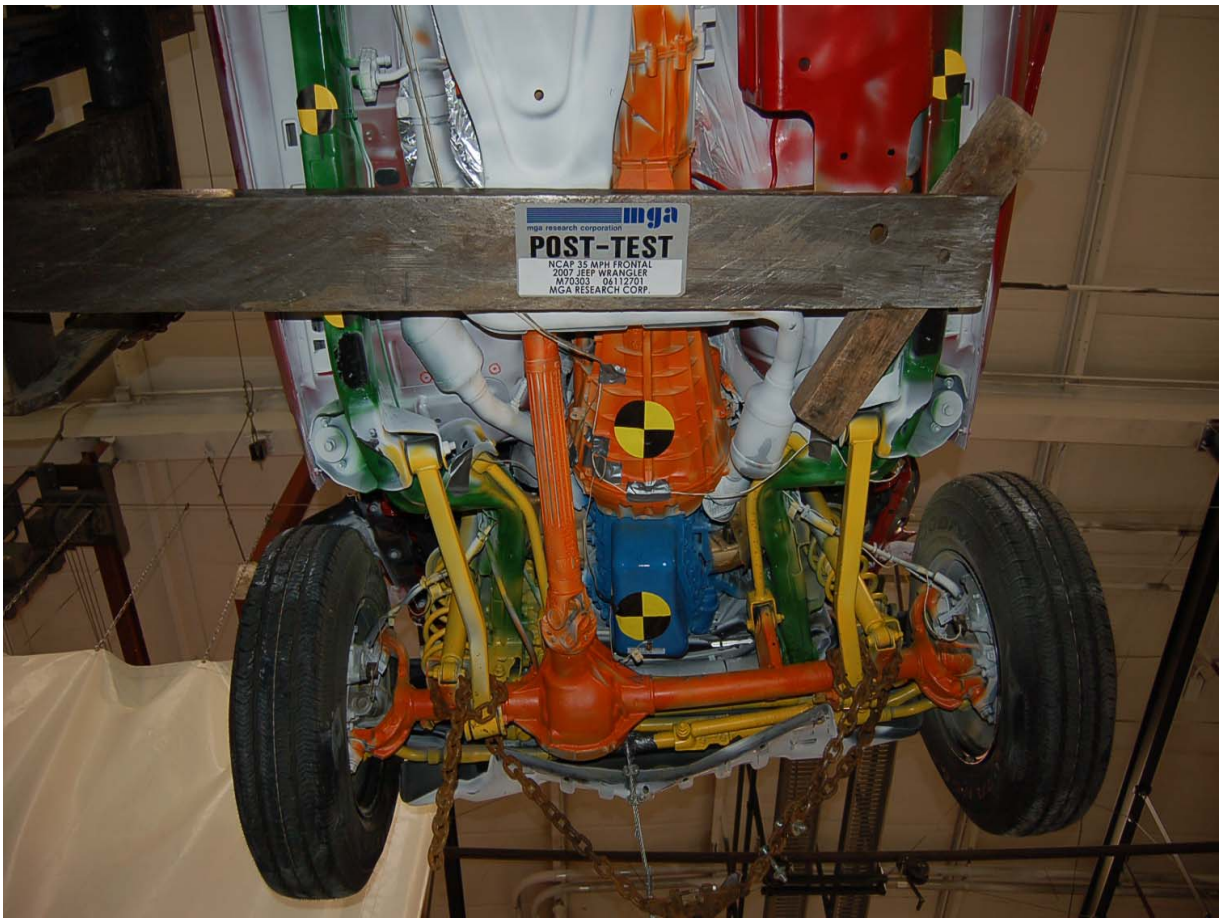


Post-Test Engine Compartment View

Pre-Test Fuel Cap View

Post-Test Fuel Cap View

Pre-Test Front Underbody View

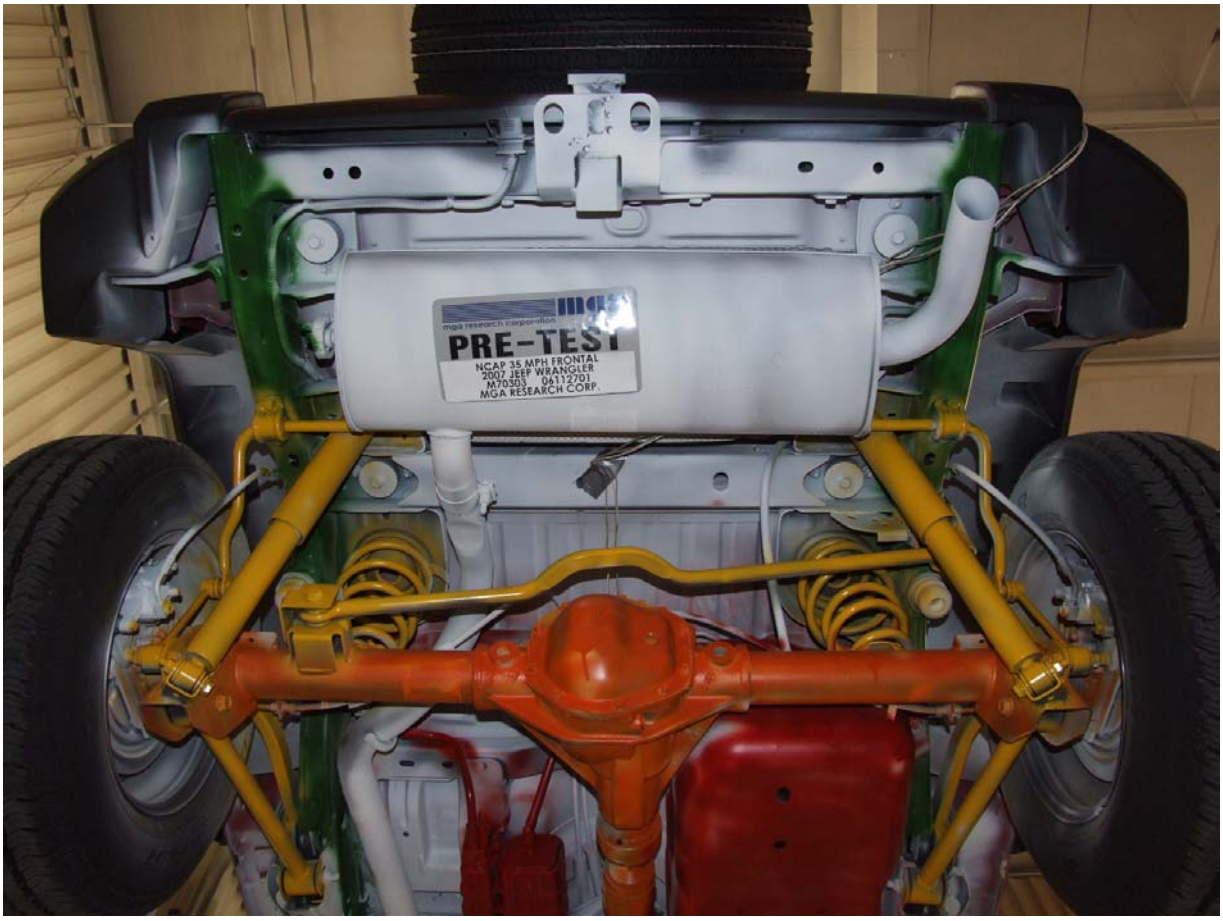


Post-Test Front Underbody View

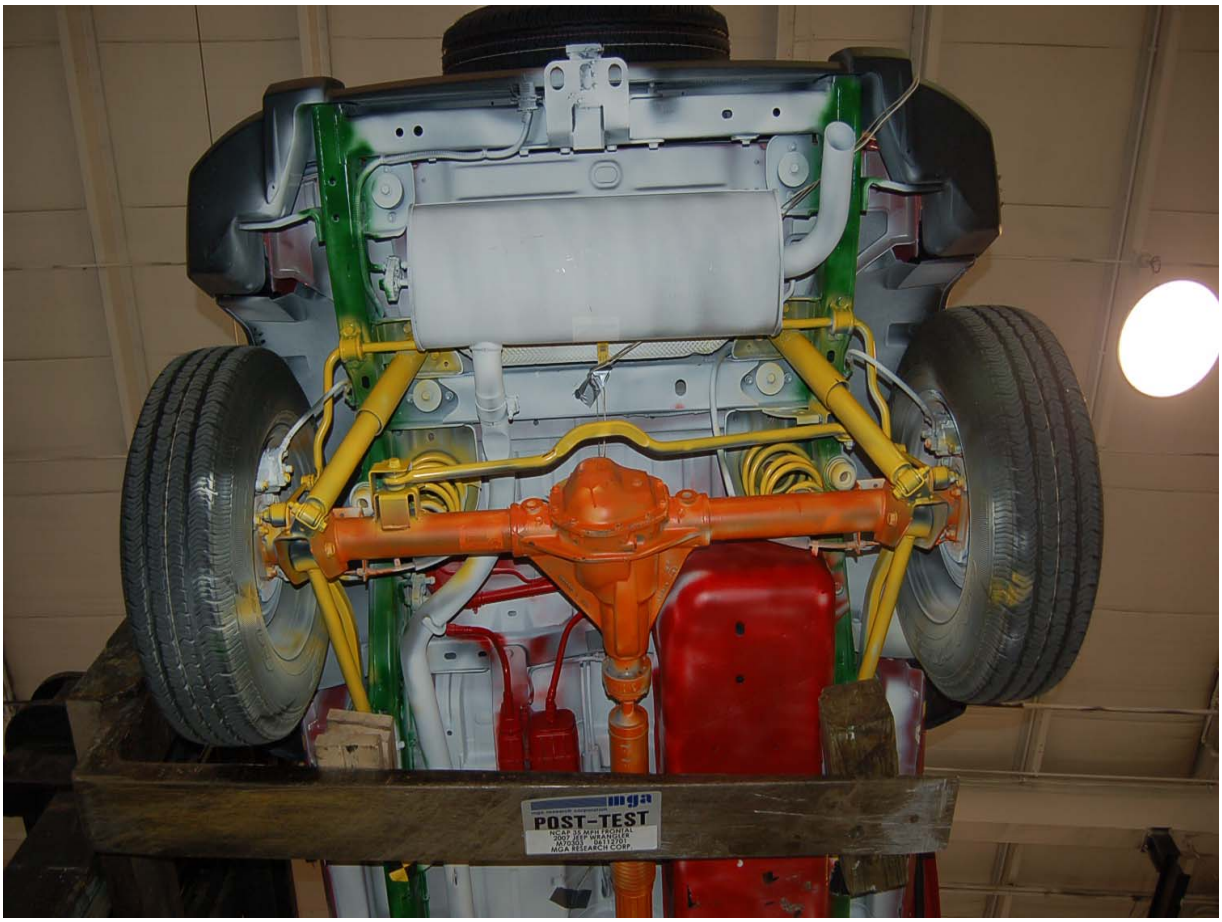
Pre-Test Mid Front Underbody View

Pre-Test Mid Rear Underbody View

Post-Test Mid Underbody View



Pre-Test Rear Underbody View



Post-Test Rear Underbody View

Pre-Test Driver Dummy Front View (Head Position)

Post-Test Driver Dummy Front View (Head Position)

Pre-Test Driver Dummy (Through Window)

Post-Test Driver Dummy (Through Window)

Pre-Test Driver Dummy (Door Open)

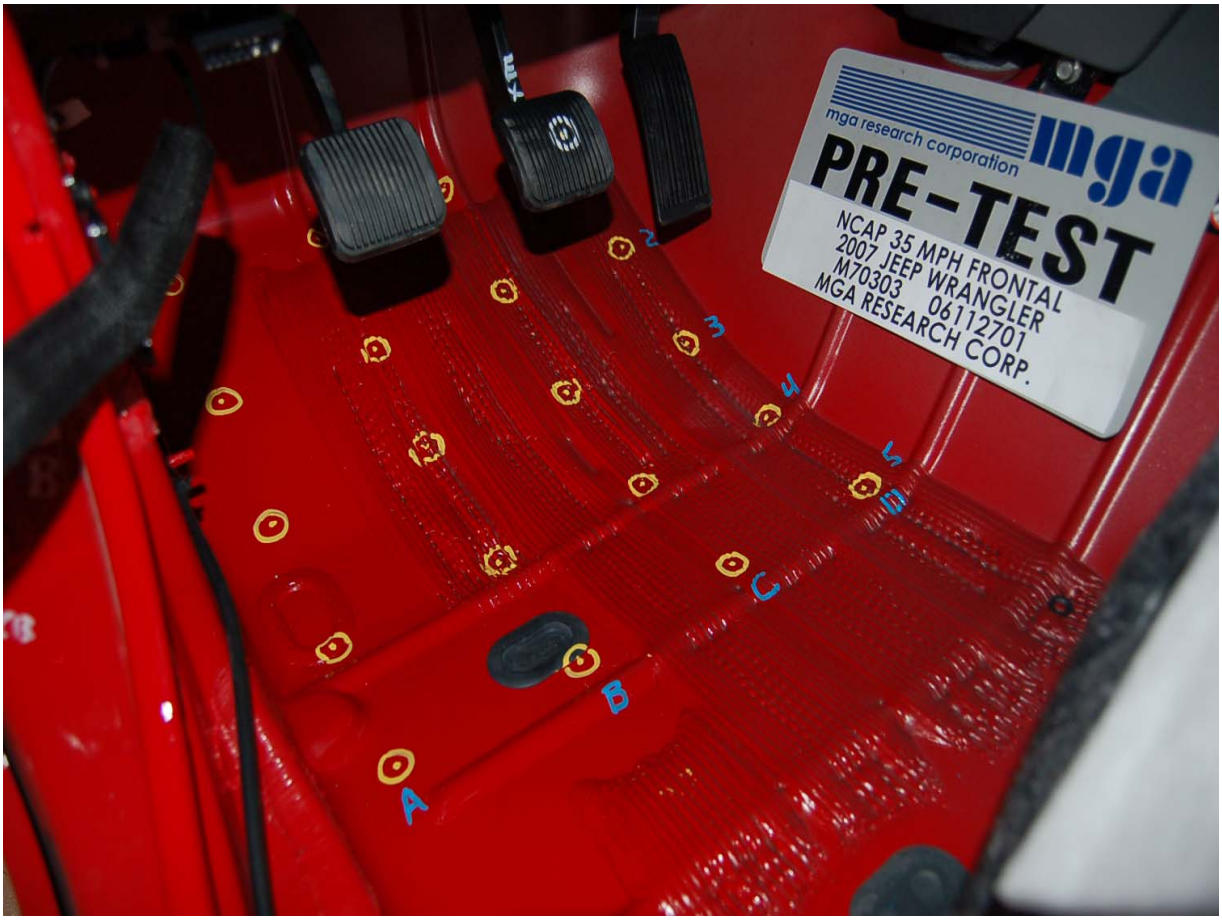
Post-Test Driver Dummy (Door Open)

Pre-Test Driver Dummy Feet

Post-Test Driver Dummy Feet

Pre-Test Driver Side Knee Bolster

Post-Test Driver Side Knee Bolster



Pre-Test Driver Side Floor Pan

Post-Test Driver Side Floor Pan

Post-Test Driver Dummy Head Contact (headrest)

Post-Test Driver Dummy Knee Contact

Post-Test Driver Dummy Airbag Contact

Pre-Test Passenger Dummy Front View (Head Position)

Post-Test Passenger Dummy Front View (Head Position)

Pre-Test Passenger Dummy (Through Window)

Post-Test Passenger Dummy (Through Window)

Pre-Test Passenger Dummy (Door Open)

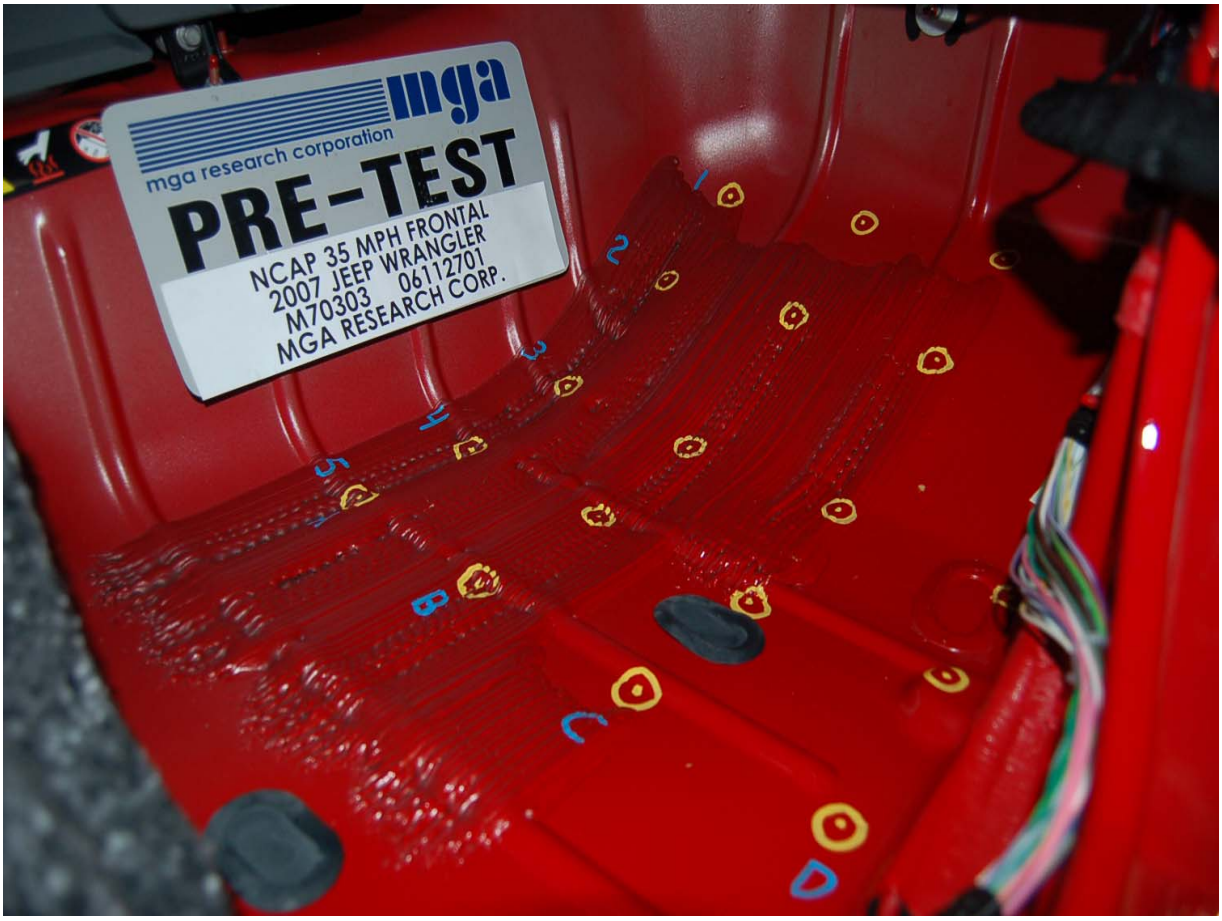
Post-Test Passenger Dummy (Door Open)

Pre-Test Passenger Dummy Feet

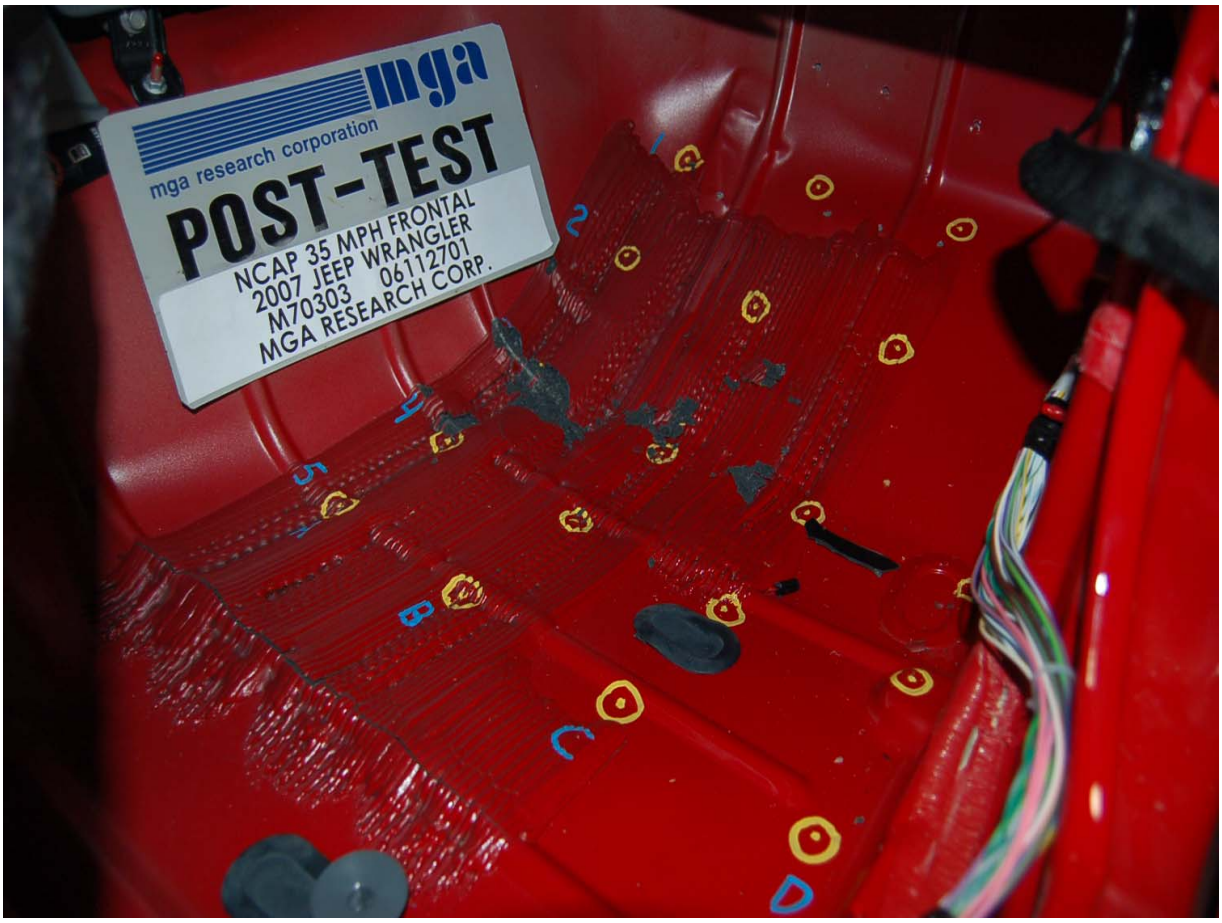
Post-Test Passenger Dummy Feet

Pre-Test Passenger Side Glove Box

Post-Test Passenger Side Glove Box



Pre-Test Passenger Side Floor Pan



Post-Test Passenger Side Floor Pan

Post-Test Passenger Dummy Head Contact (headrest)

Post-Test Passenger Dummy Knee Contact

Post-Test Passenger Dummy Airbag Contact

Rollover 90 Degrees

Rollover 180 Degrees

Rollover 270 Degrees

Rollover 360 Degrees

Vehicle Impact

APPENDIX B

DUMMY RESPONSE DATA TRACES

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The following dummy and vehicle response data can be found in the R&D section of the NHTSA website at www.nhtsa.dot.gov

Driver Head X Redundant

Driver Head Y Redundant

Driver Head Z Redundant

Driver Upper Neck Force X

Driver Upper Neck Force Y

Driver Upper Neck Force Z

Driver Upper Neck Moment X

Driver Upper Neck Moment Y

Driver Upper Neck Moment Z

Driver Chest X Redundant

Driver Chest Y Redundant

Driver Chest Z Redundant

Driver Chest Displacement

Driver Pelvis X

Driver Pelvis Y

Driver Pelvis Z

Driver Shoulder Belt Force

Driver Lap Belt Force

Driver Left Upper Tibia Moment X

Driver Left Upper Tibia Moment Y

Driver Left Upper Tibia Force Z

Driver Left Lower Tibia Moment X

Driver Left Lower Tibia Moment Y

Driver Left Lower Tibia Force Z

Driver Right Upper Tibia Moment X

Driver Right Upper Tibia Moment Y

Driver Right Upper Tibia Force Z

Driver Right Lower Tibia Moment X

Driver Right Lower Tibia Moment Y

Driver Right Lower Tibia Force Z

Driver Left Foot Fore Z

Driver Left Foot Aft X

Driver Left Foot Aft Z

Driver Right Foot Fore Z

Driver Right Foot Aft X

Driver Right Foot Aft Z

Passenger Head X Redundant

Passenger Head Y Redundant

Passenger Head Z Redundant

Passenger Upper Neck Force X

Passenger Upper Neck Force Y

Passenger Upper Neck Force Z

Passenger Upper Neck Moment X

Passenger Upper Neck Moment Y

Passenger Upper Neck Moment Z

Passenger Chest X Redundant

Passenger Chest Y Redundant

Passenger Chest Z Redundant

Passenger Chest Displacement

Passenger Pelvis X

Passenger Pelvis Y

Passenger Pelvis Z

Passenger Shoulder Belt Force

Passenger Lap Belt Force

Passenger Left Upper Tibia Moment X

Passenger Left Upper Tibia Moment Y

Passenger Left Upper Tibia Force Z

Passenger Left Lower Tibia Moment X

Passenger Left Lower Tibia Moment Y

Passenger Left Lower Tibia Force Z

Passenger Right Upper Tibia Moment X

Passenger Right Upper Tibia Moment Y

Passenger Right Upper Tibia Force Z

Passenger Right Lower Tibia Moment X

Passenger Right Lower Tibia Moment Y

Passenger Right Lower Tibia Force Z

Passenger Left Foot Fore Z

Passenger Left Foot Aft X

Passenger Left Foot Aft Z

Passenger Right Foot Fore Z

Passenger Right Foot Aft X

Passenger Right Foot Aft Z

Left Rear Seat Crossmember X

Left Rear Seat Crossmember Z

Right Rear Seat Crossmember X

Right Rear Seat Crossmember Z

Vehicle Engine Top X

Vehicle Engine Bottom X

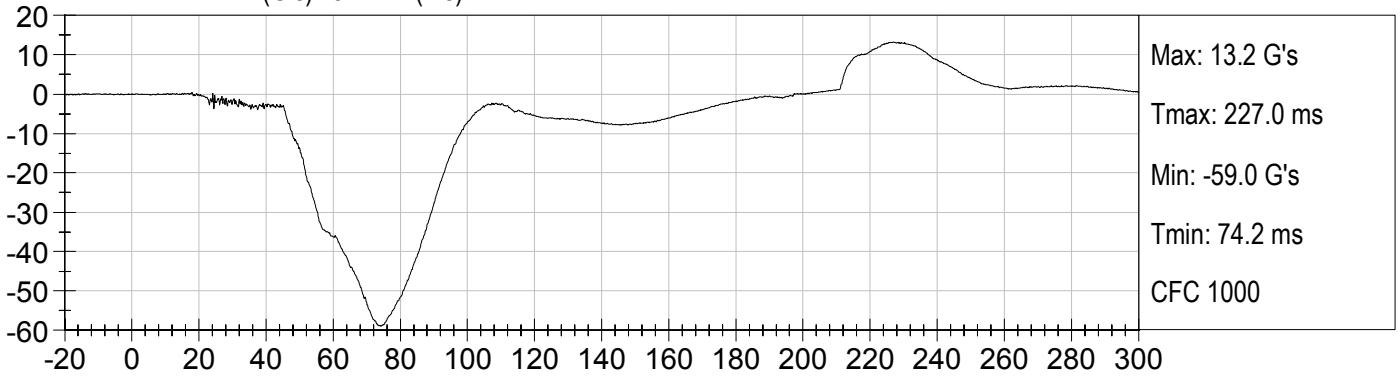
Vehicle Left Brake Caliper X

Vehicle Right Brake Caliper X

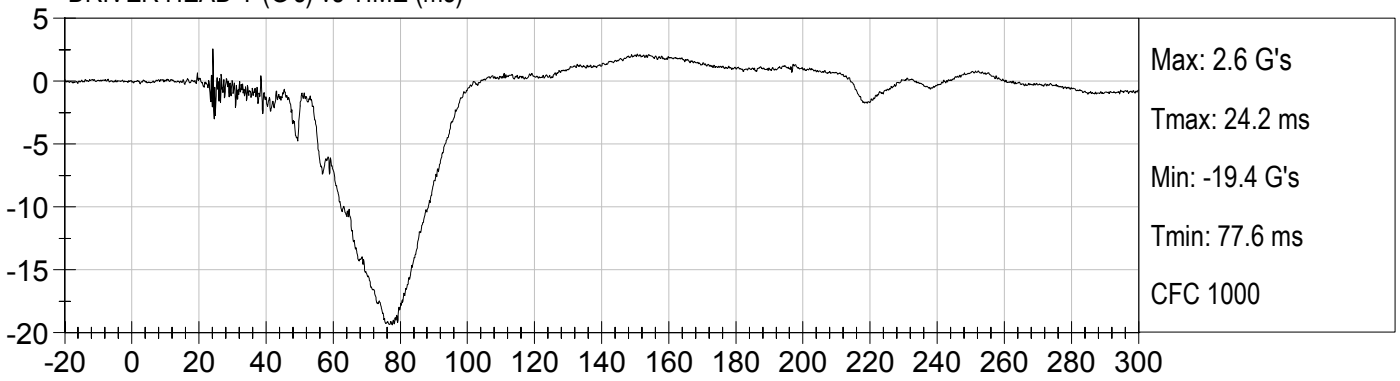
NCAP 35 MPH FRONTAL
2007 JEEP WRANGLER

Test Date: 11/27/2006
Speed: 35.1 mph (56.5 km/h)

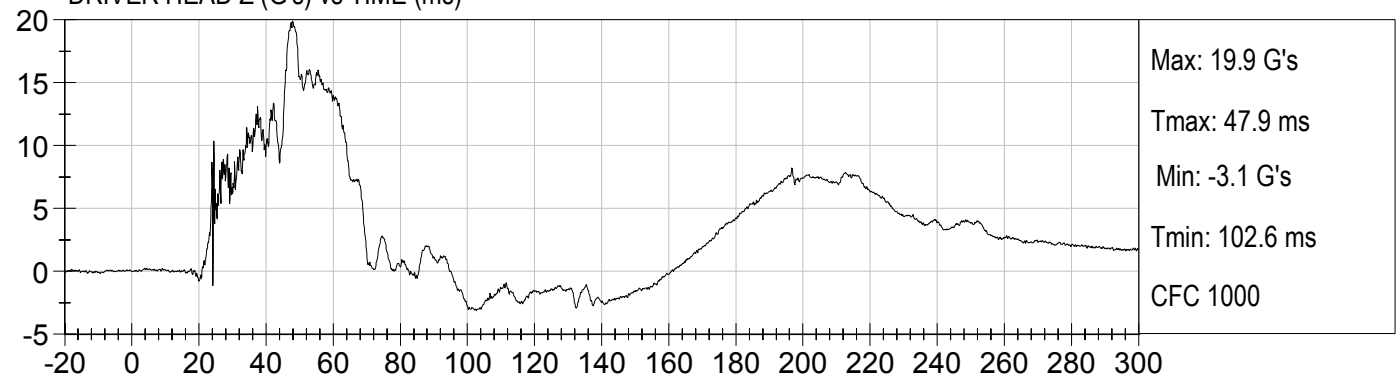
DRIVER HEAD X (G's) vs TIME (ms)



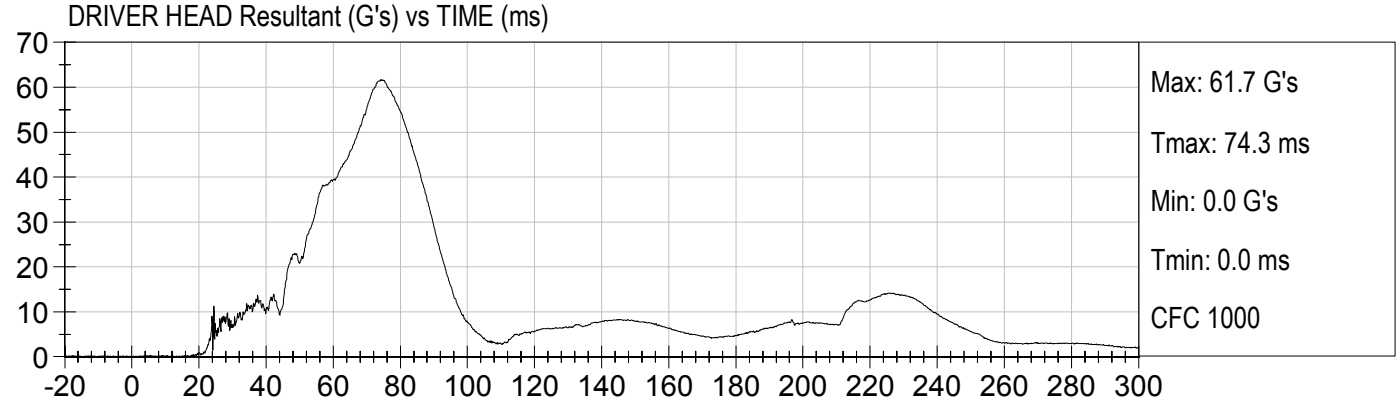
DRIVER HEAD Y (G's) vs TIME (ms)



DRIVER HEAD Z (G's) vs TIME (ms)



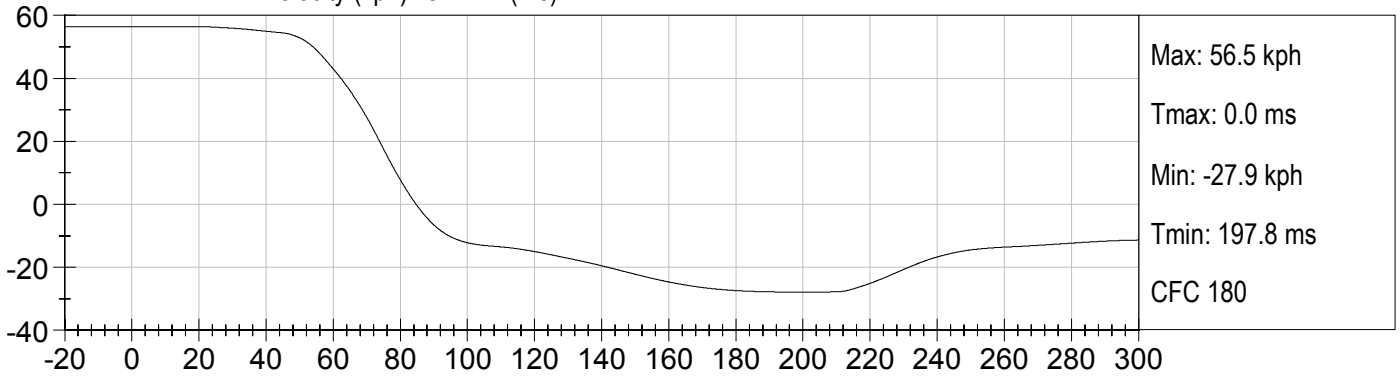
DRIVER HEAD Resultant (G's) vs TIME (ms)



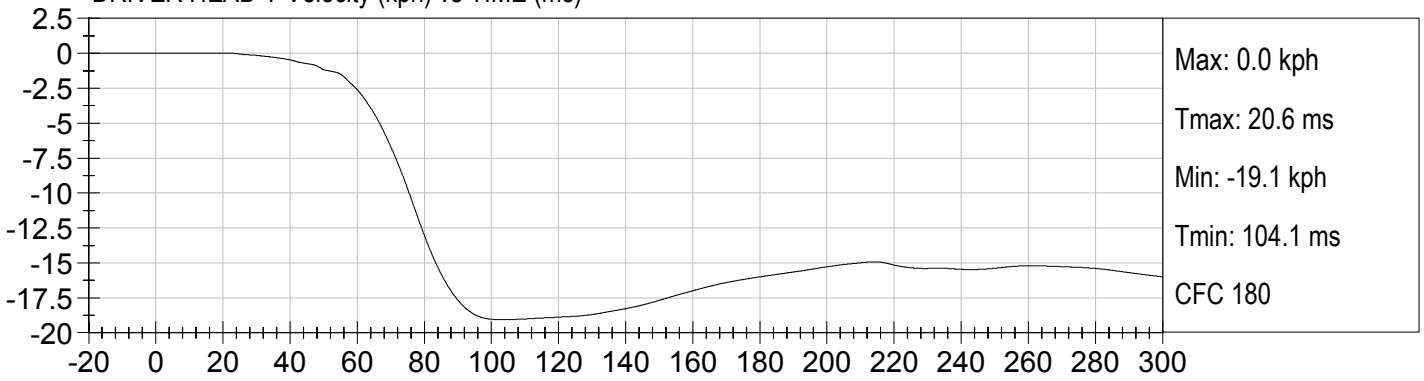
NCAP 35 MPH FRONTAL
2007 JEEP WRANGLER

Test Date: 11/27/2006
Speed: 35.1 mph (56.5 km/h)

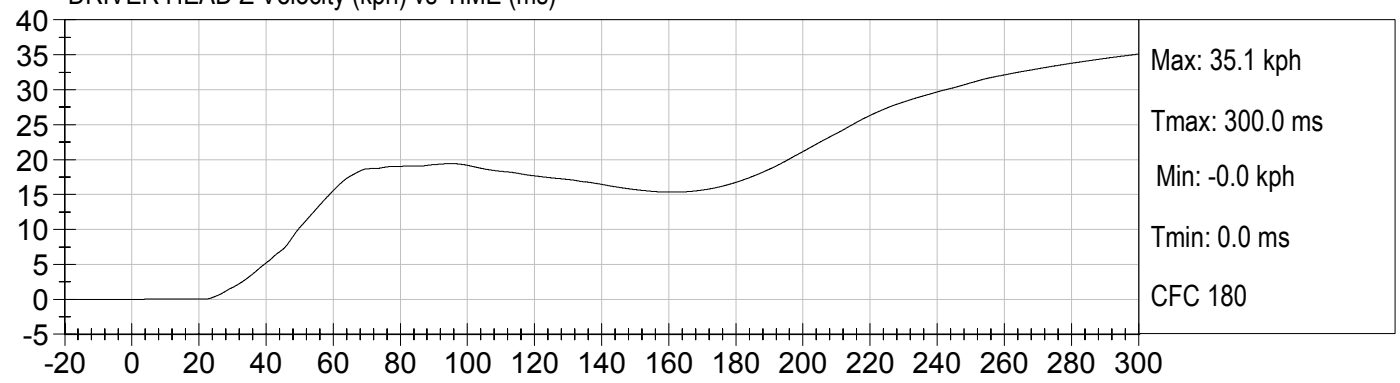
DRIVER HEAD X Velocity (kph) vs TIME (ms)



DRIVER HEAD Y Velocity (kph) vs TIME (ms)



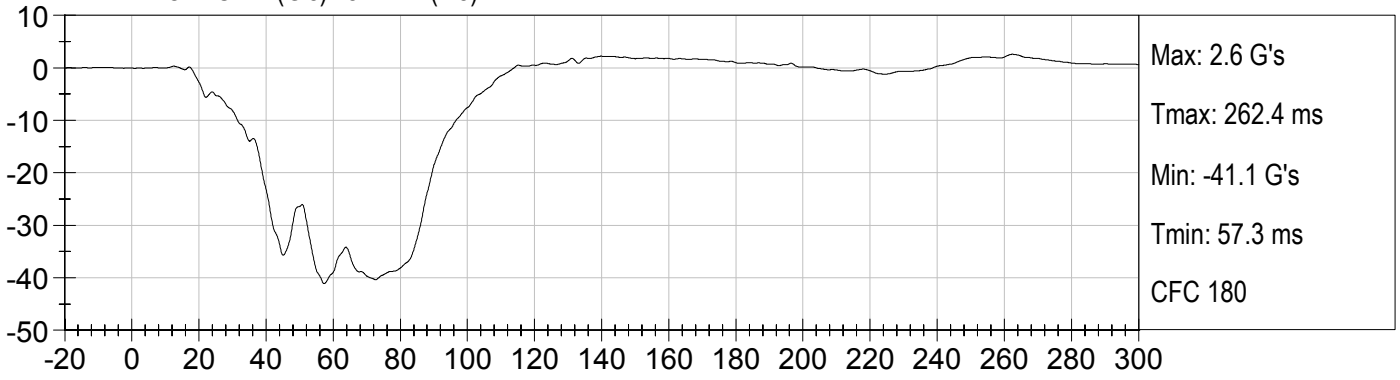
DRIVER HEAD Z Velocity (kph) vs TIME (ms)



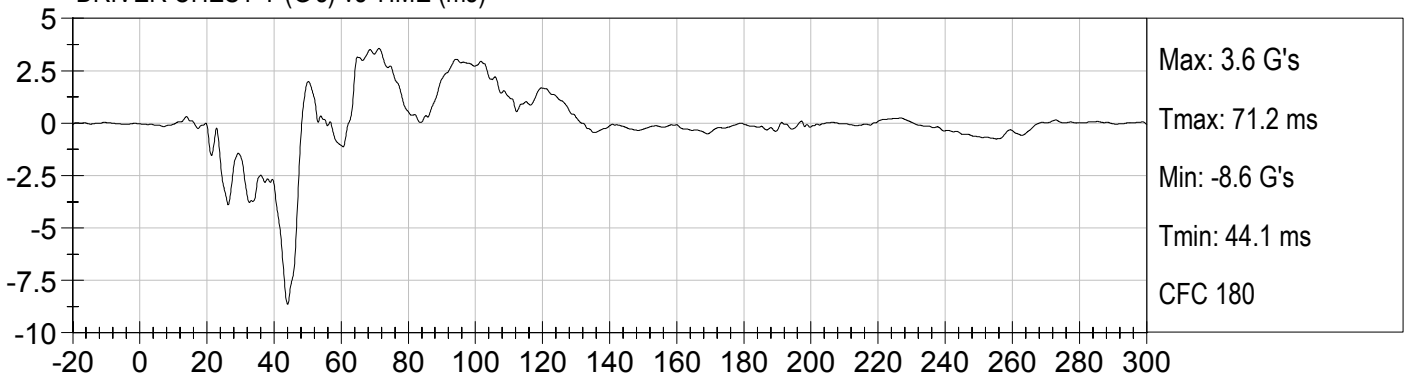
NCAP 35 MPH FRONTAL
2007 JEEP WRANGLER

Test Date: 11/27/2006
Speed: 35.1 mph (56.5 km/h)

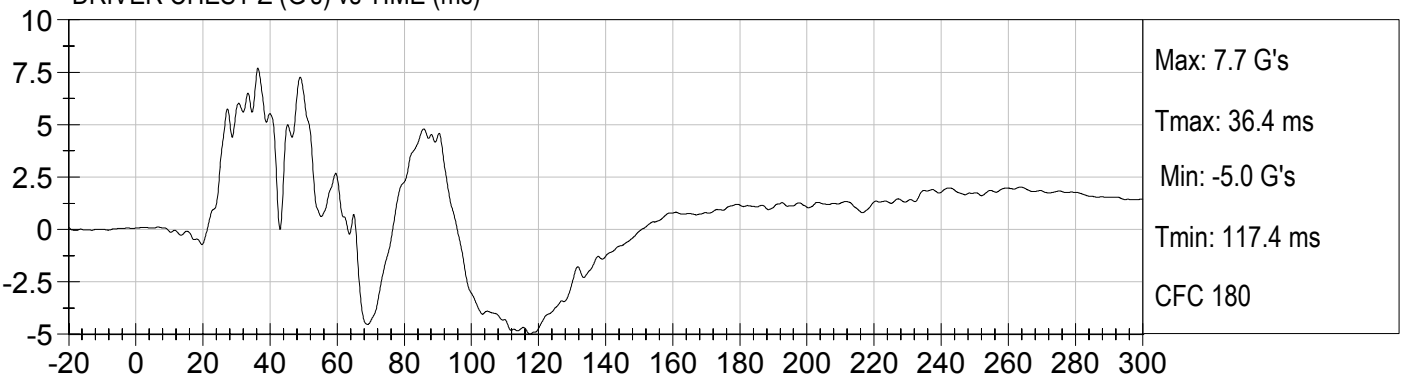
DRIVER CHEST X (G's) vs TIME (ms)



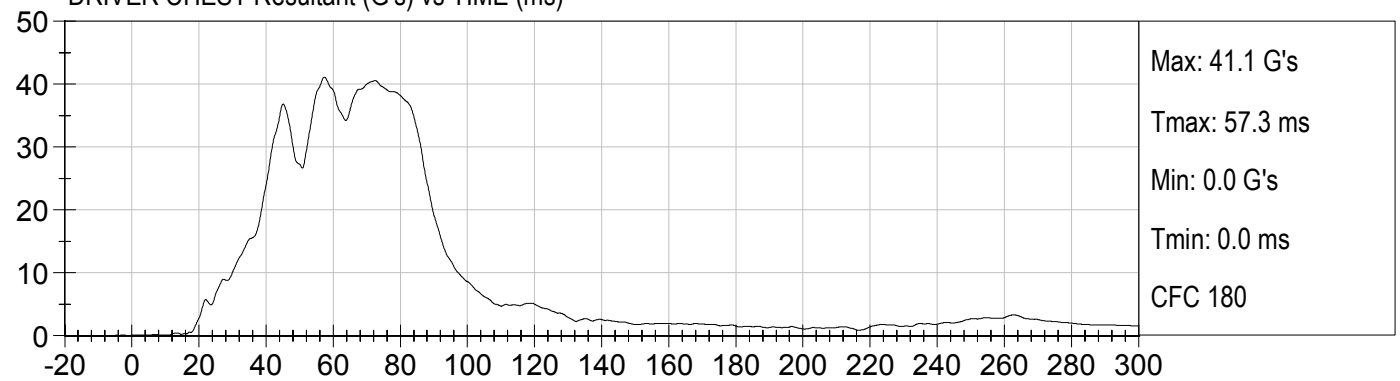
DRIVER CHEST Y (G's) vs TIME (ms)

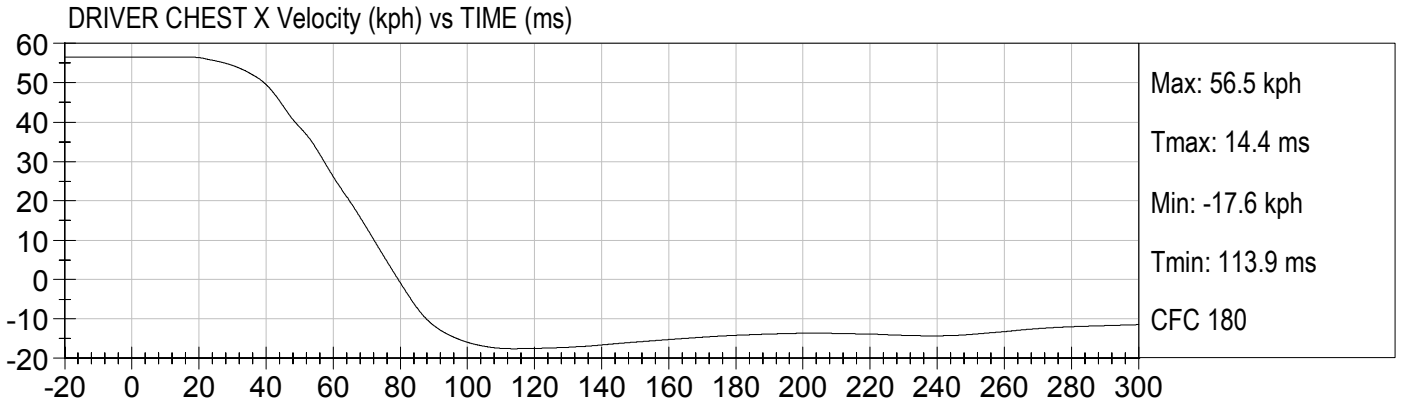


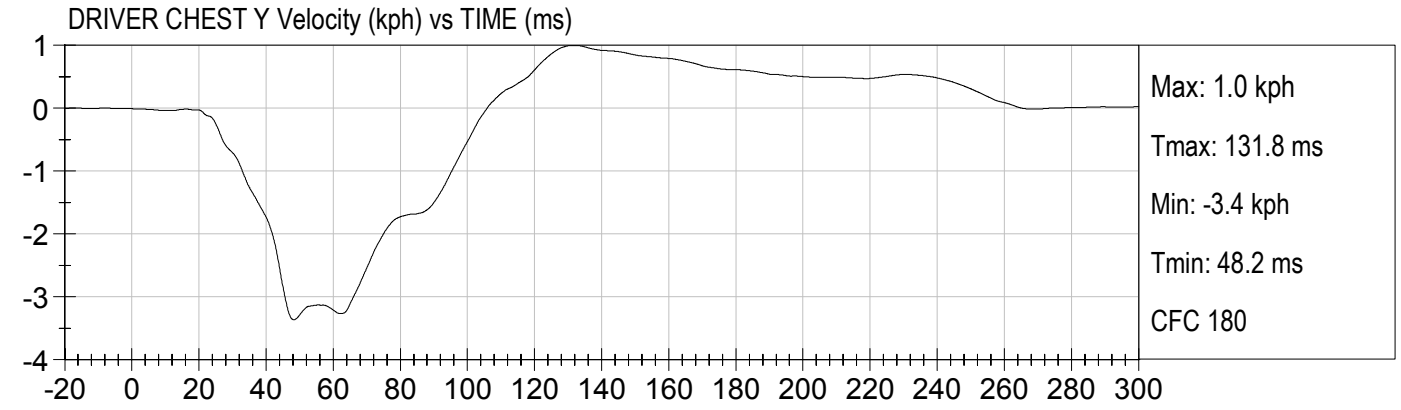
DRIVER CHEST Z (G's) vs TIME (ms)

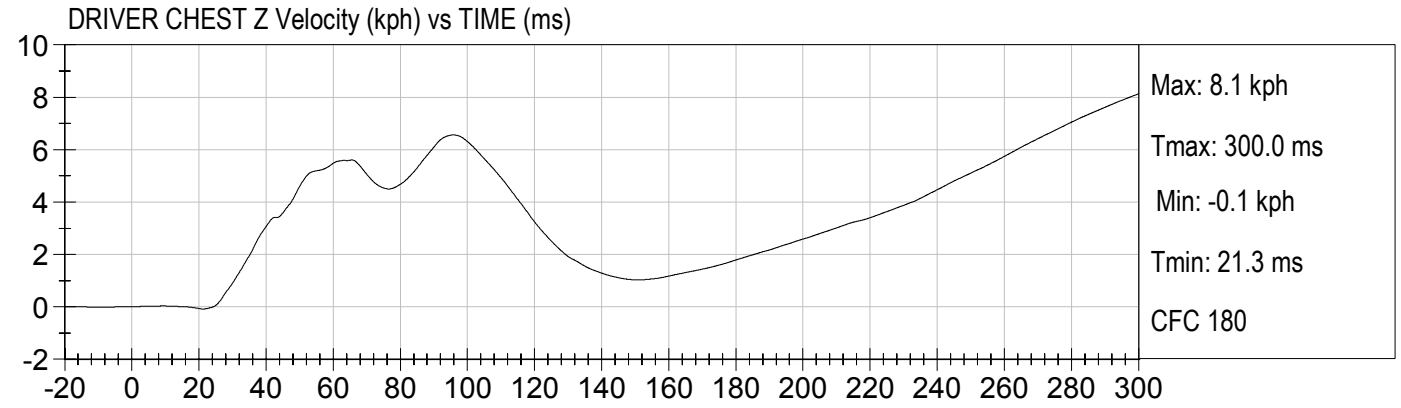


DRIVER CHEST Resultant (G's) vs TIME (ms)

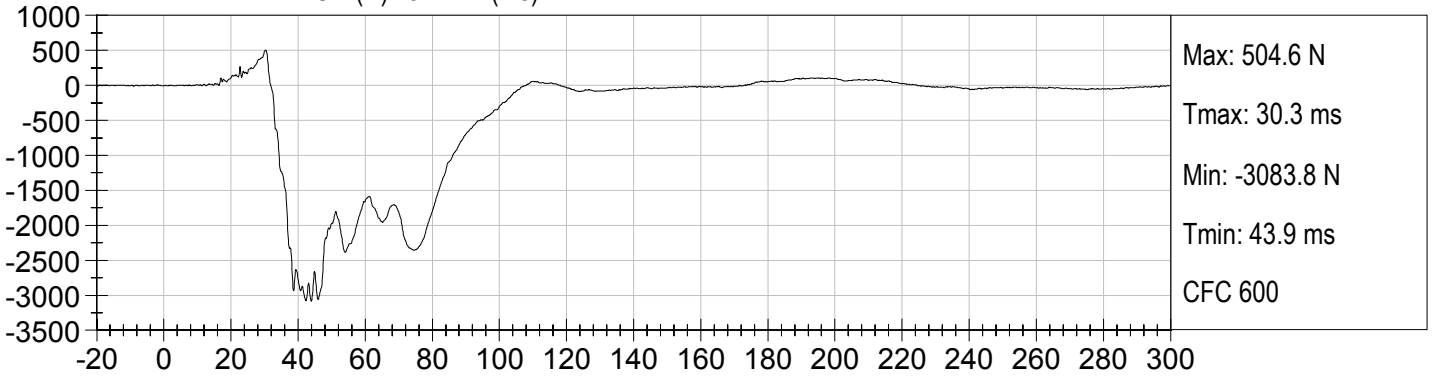



DRIVER CHEST X Velocity (kph) vs TIME (ms)
60
50
40
30
20
10
0
-10
-20
-20 0 20 40 60 80 100 120 140 160 180 200 220 240 260 280 300
Max: 56.5 kph
Tmax: 14.4 ms
Min: -17.6 kph
Tmin: 113.9 ms
CFC 180

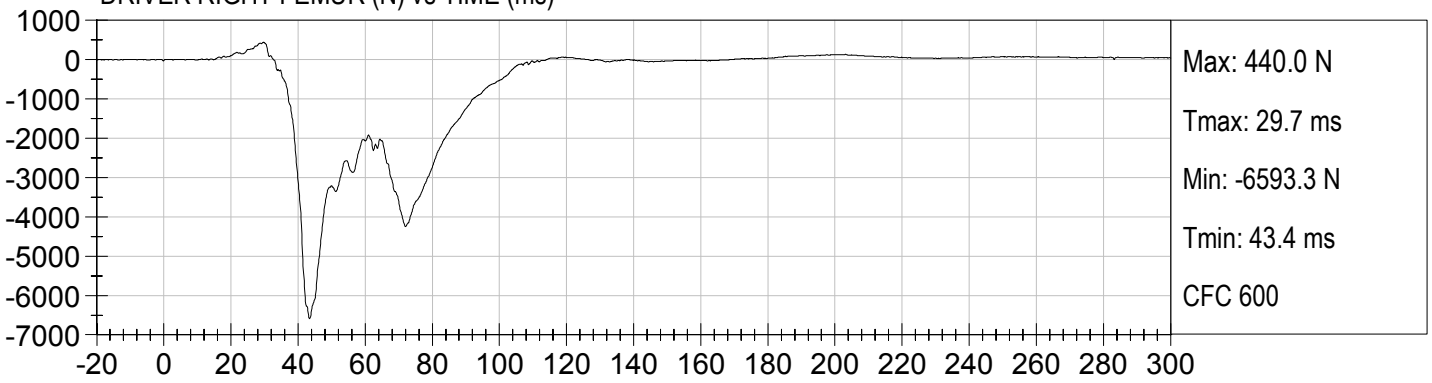

DRIVER CHEST Y Velocity (kph) vs TIME (ms)
1
0
-1
-2
-3
-4
-20 0 20 40 60 80 100 120 140 160 180 200 220 240 260 280 300
Max: 1.0 kph
Tmax: 131.8 ms
Min: -3.4 kph
Tmin: 48.2 ms
CFC 180


DRIVER CHEST Z Velocity (kph) vs TIME (ms)
10
8
6
4
2
0
-2
-20 0 20 40 60 80 100 120 140 160 180 200 220 240 260 280 300
Max: 8.1 kph
Tmax: 300.0 ms
Min: -0.1 kph
Tmin: 21.3 ms
CFC 180

DRIVER LEFT FEMUR (N) vs TIME (ms)



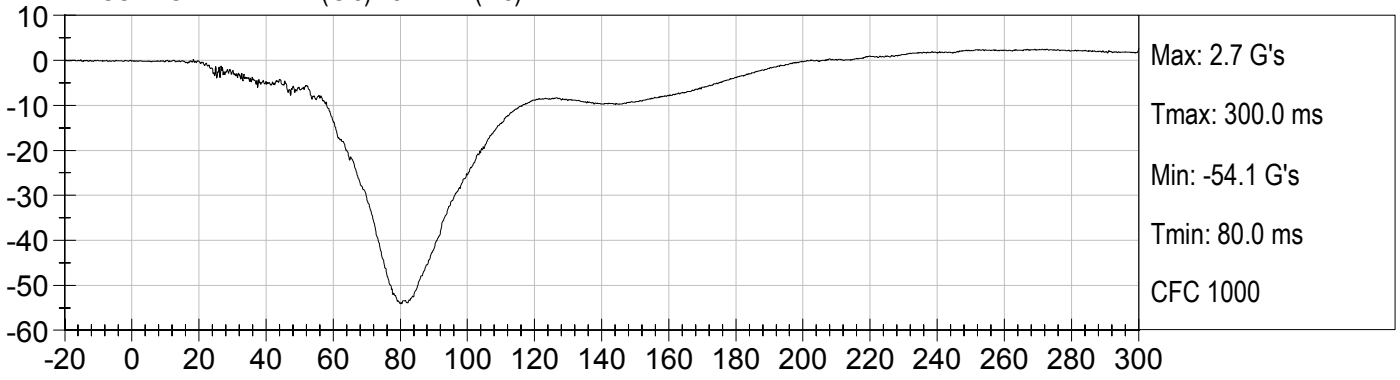
DRIVER RIGHT FEMUR (N) vs TIME (ms)



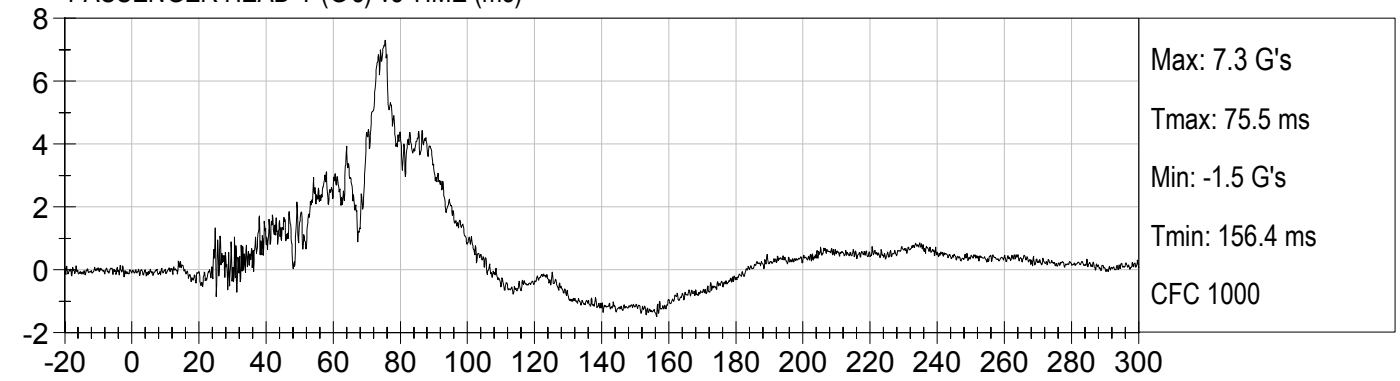
NCAP 35 MPH FRONTAL
2007 JEEP WRANGLER

Test Date: 11/27/2006
Speed: 35.1 mph (56.5 km/h)

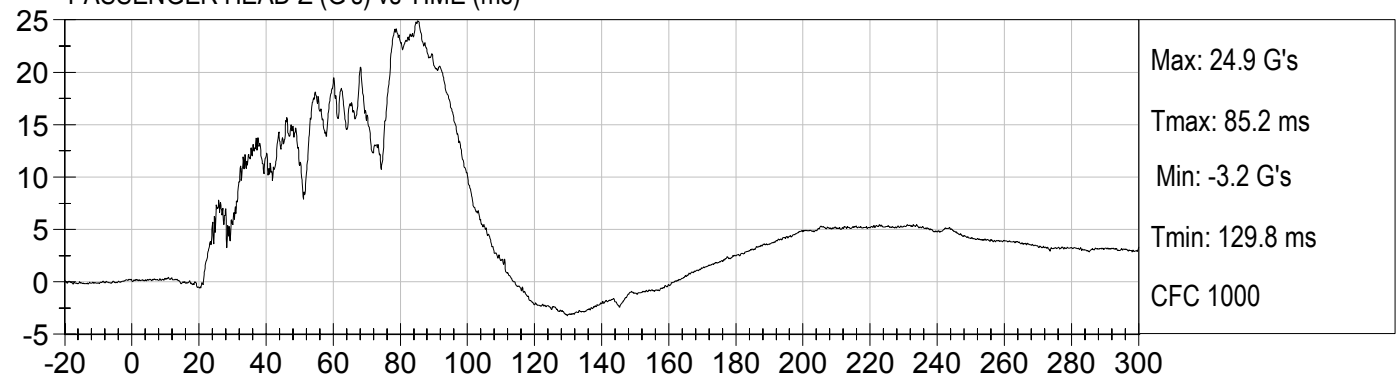
PASSENGER HEAD X (G's) vs TIME (ms)



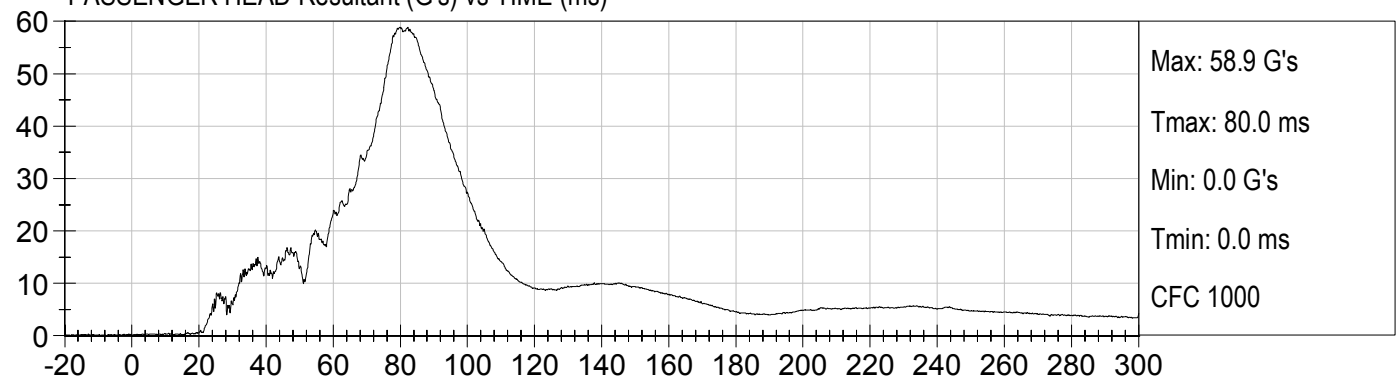
PASSENGER HEAD Y (G's) vs TIME (ms)

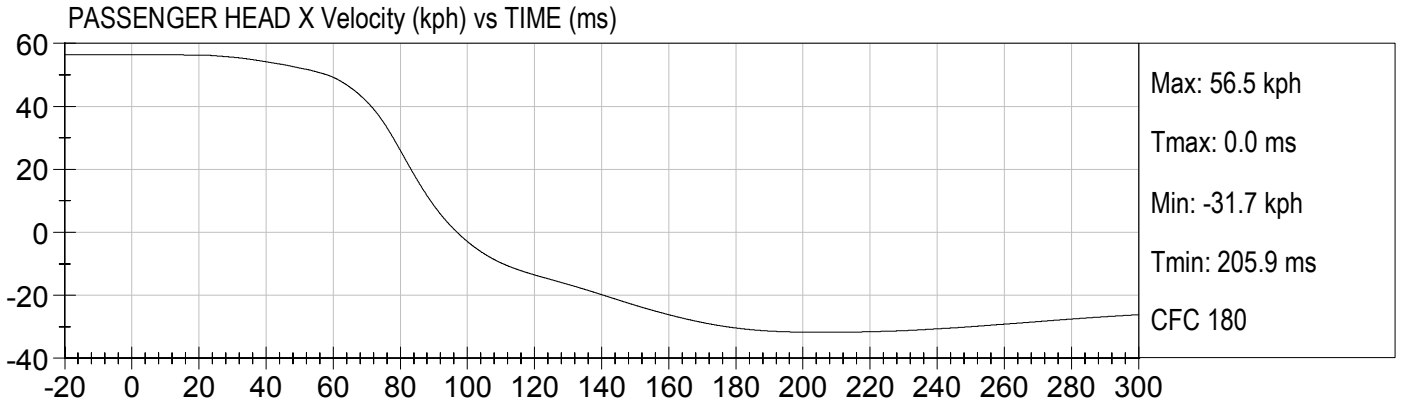


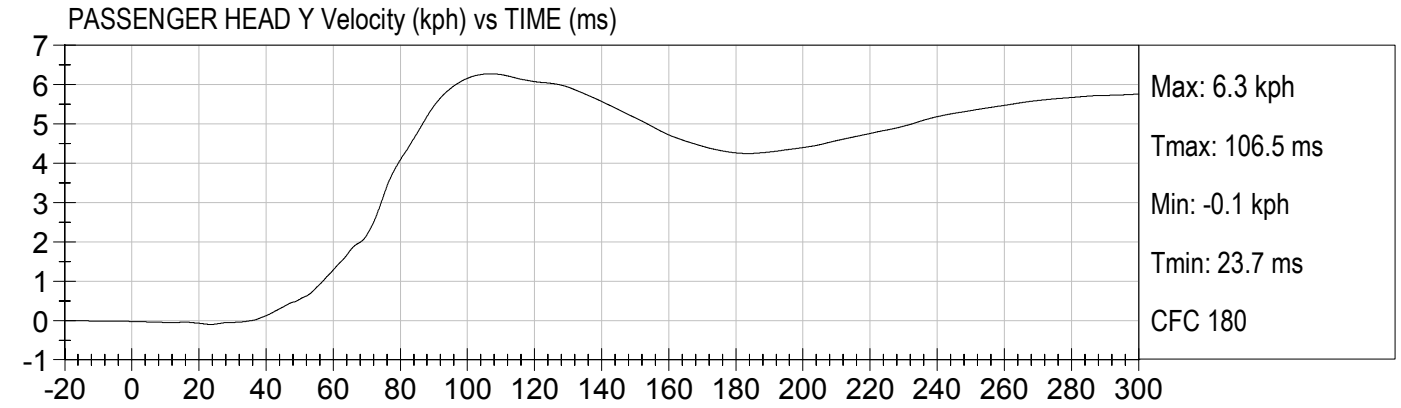
PASSENGER HEAD Z (G's) vs TIME (ms)

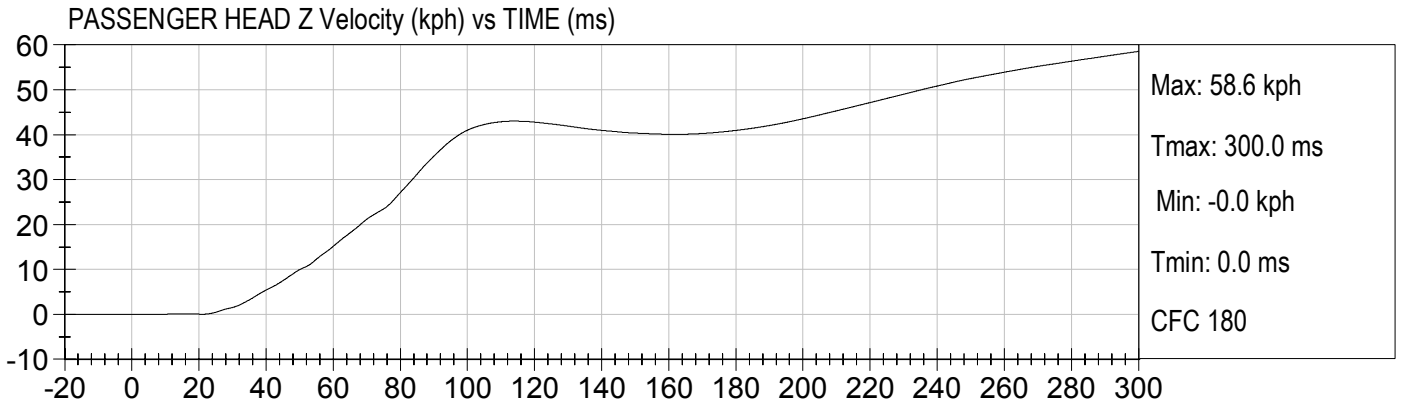


PASSENGER HEAD Resultant (G's) vs TIME (ms)

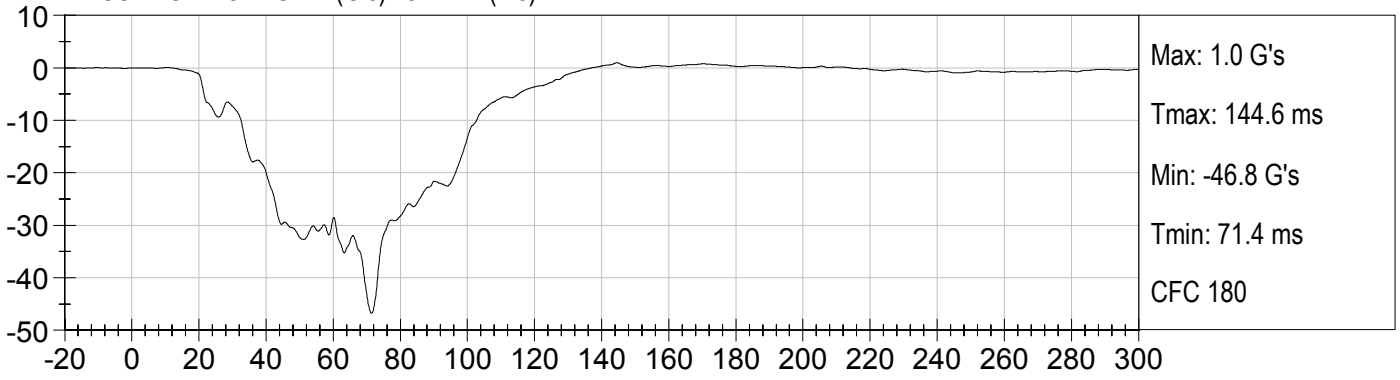



PASSENGER HEAD X Velocity (kph) vs TIME (ms)
60
40
20
0
-20
-40
-20 0 20 40 60 80 100 120 140 160 180 200 220 240 260 280 300
Max: 56.5 kph
Tmax: 0.0 ms
Min: -31.7 kph
Tmin: 205.9 ms
CFC 180

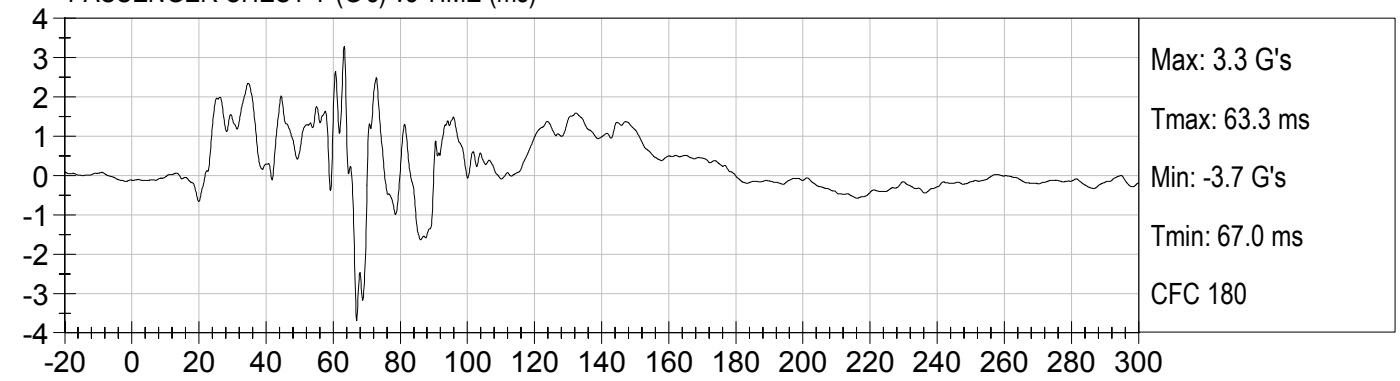

PASSENGER HEAD Y Velocity (kph) vs TIME (ms)
7
6
5
4
3
2
1
0
-1
-20 0 20 40 60 80 100 120 140 160 180 200 220 240 260 280 300
Max: 6.3 kph
Tmax: 106.5 ms
Min: -0.1 kph
Tmin: 23.7 ms
CFC 180


PASSENGER HEAD Z Velocity (kph) vs TIME (ms)
60
50
40
30
20
10
0
-10
-20 0 20 40 60 80 100 120 140 160 180 200 220 240 260 280 300
Max: 58.6 kph
Tmax: 300.0 ms
Min: -0.0 kph
Tmin: 0.0 ms
CFC 180

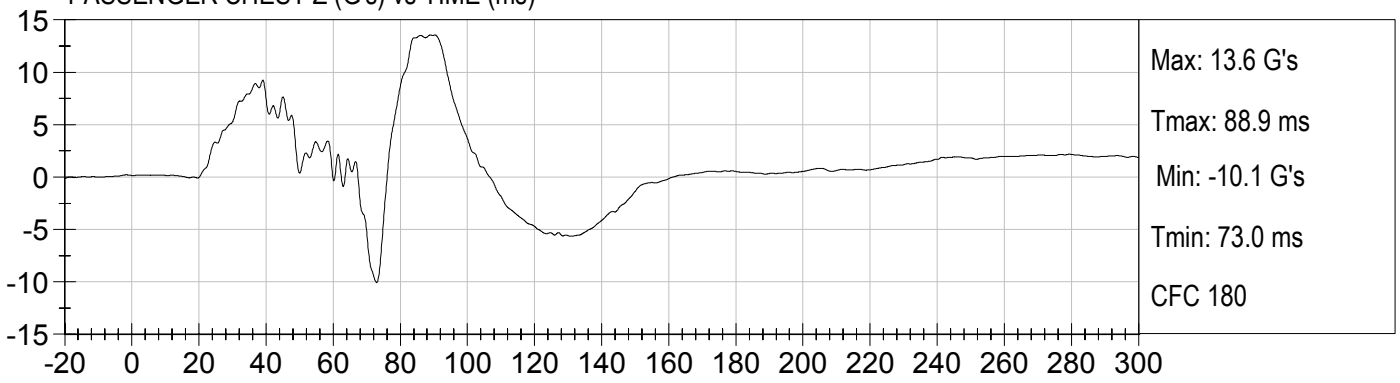
PASSENGER CHEST X (G's) vs TIME (ms)



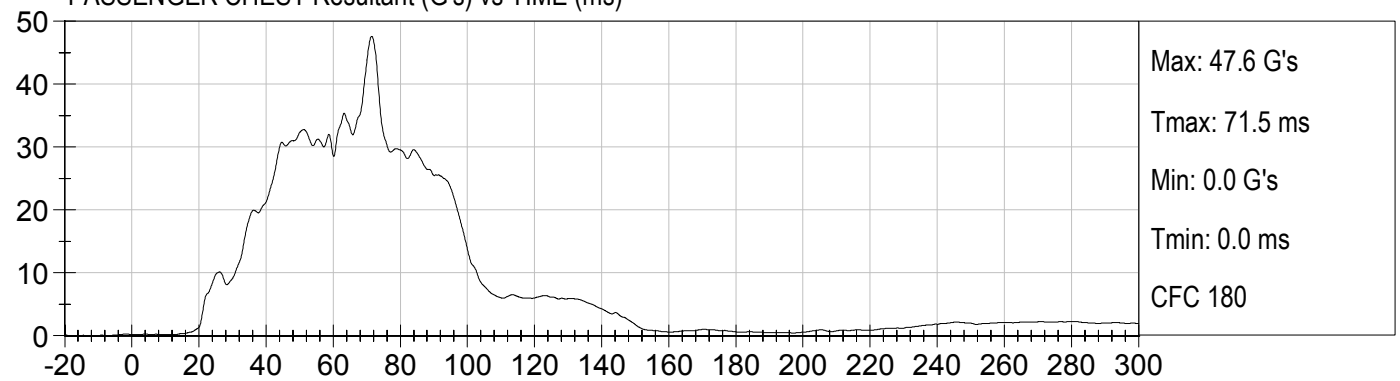
PASSENGER CHEST Y (G's) vs TIME (ms)



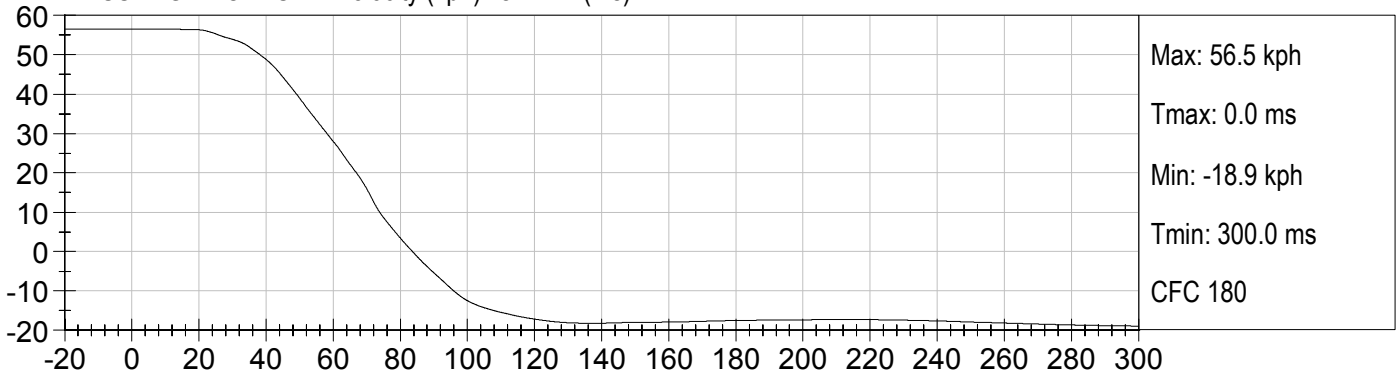
PASSENGER CHEST Z (G's) vs TIME (ms)



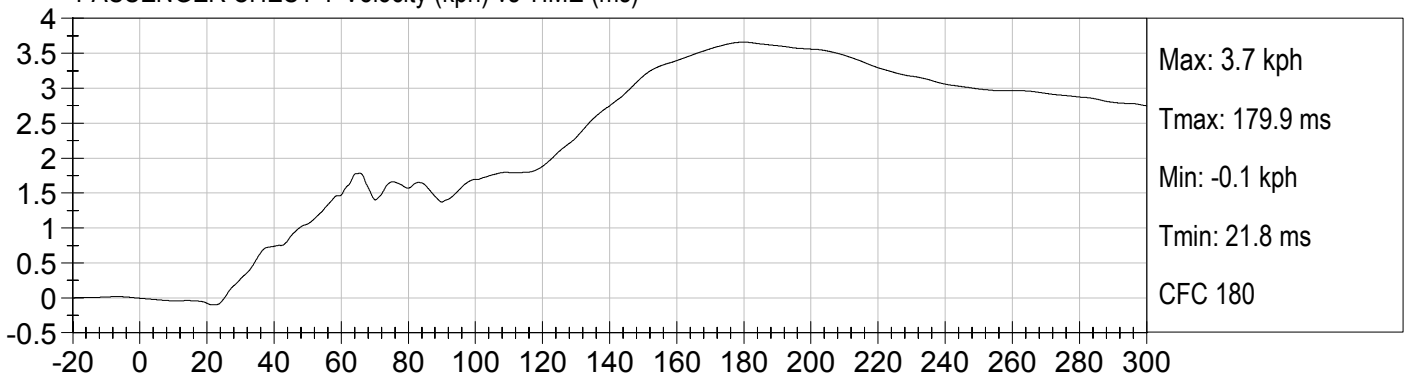
PASSENGER CHEST Resultant (G's) vs TIME (ms)



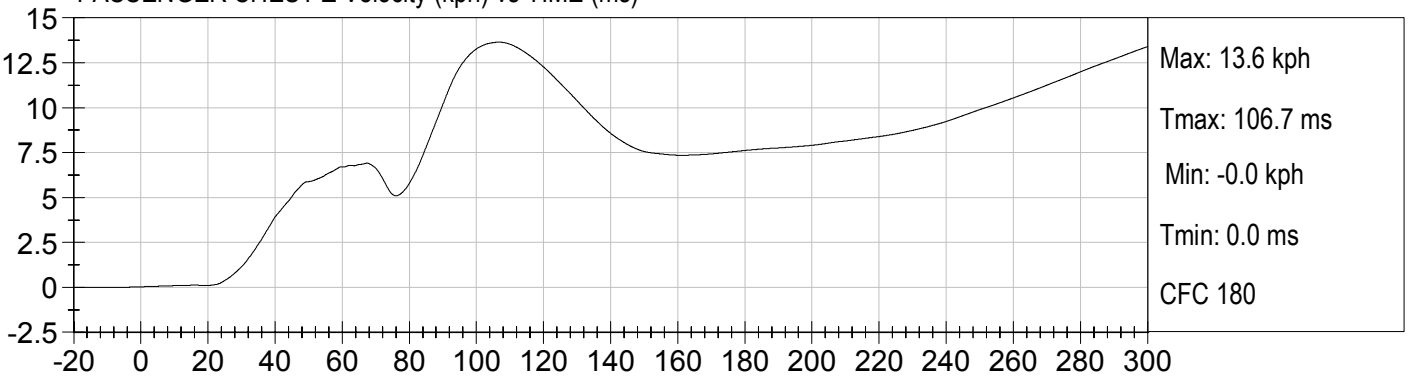
PASSENGER CHEST X Velocity (kph) vs TIME (ms)



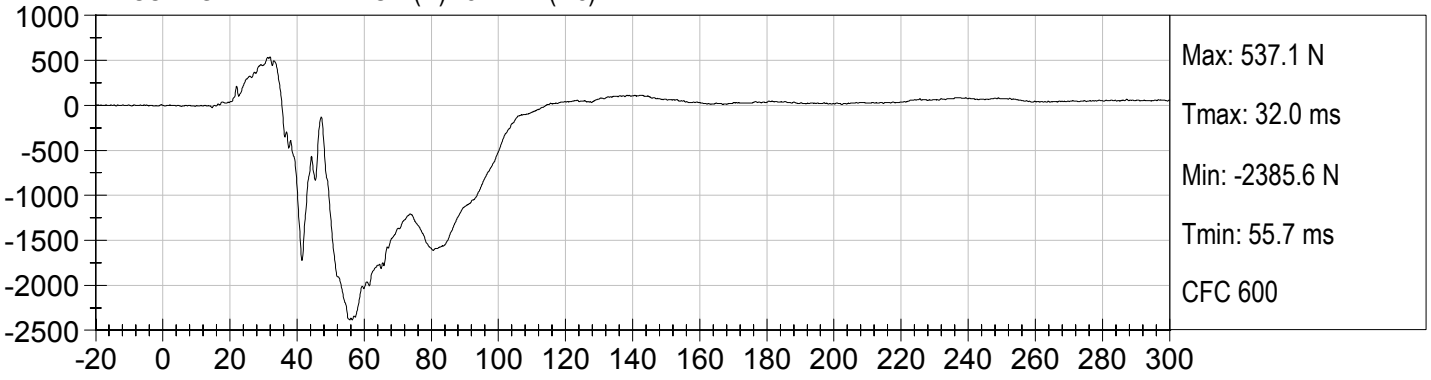
PASSENGER CHEST Y Velocity (kph) vs TIME (ms)



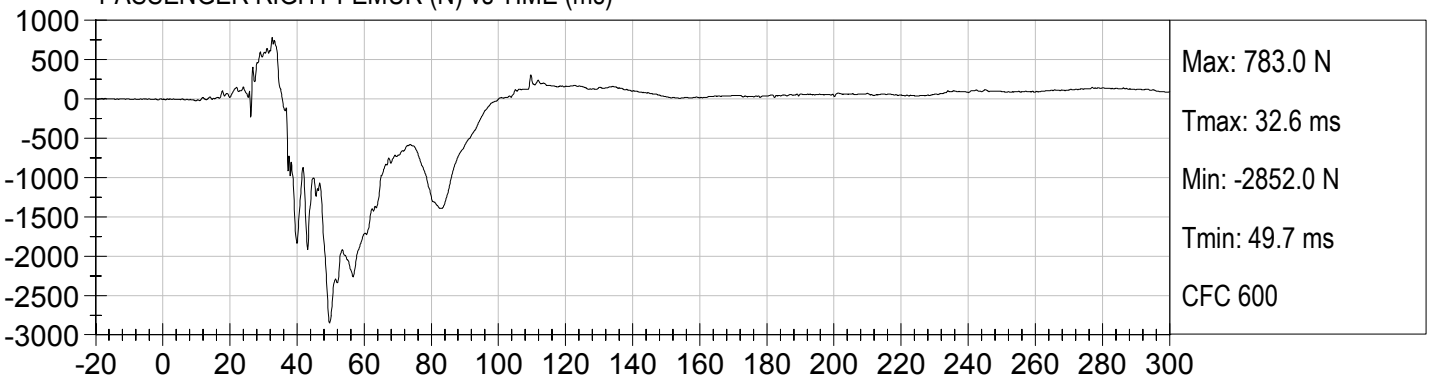
PASSENGER CHEST Z Velocity (kph) vs TIME (ms)



PASSENGER LEFT FEMUR (N) vs TIME (ms)



PASSENGER RIGHT FEMUR (N) vs TIME (ms)



APPENDIX C

DUMMY CALIBRATION DATA

MGA RESEARCH CORPORATION

HEAD DROP TEST

HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 066 **Test ID:** D063321

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 - 25.6	21.8	Pass
Laboratory Relative Humidity	%	10 to 70	24	Pass
Peak Resultant Acceleration	G's	225 - 275	265	Pass
Peak Lateral Acceleration	G's	<= +/- 15.0	2.7	Pass
Unimodal	N/A	Yes	Yes	Pass
Oscillations	N/A	within 10% of peak	Yes	Pass
		Overall Test Results		Pass

Laboratory Technician

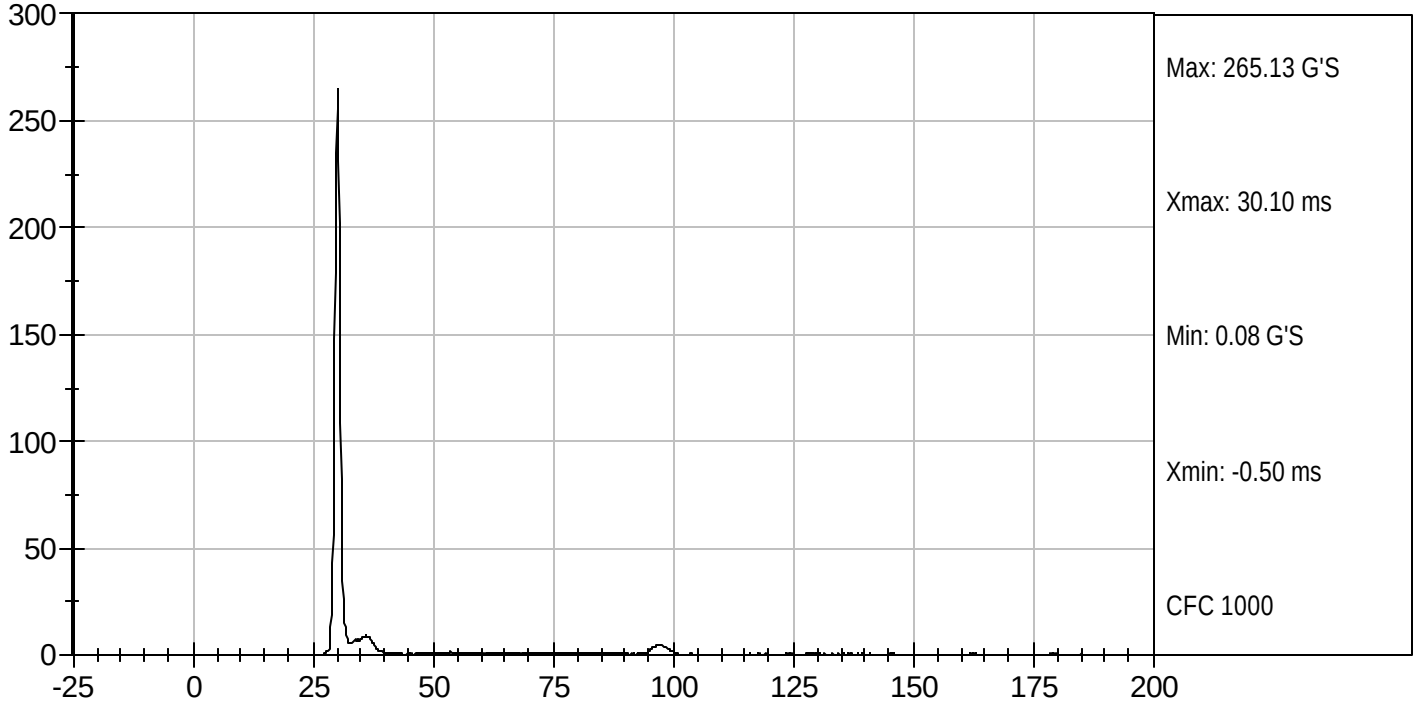
11/17/2006
Test Date

David Winkelbauer
Approved By

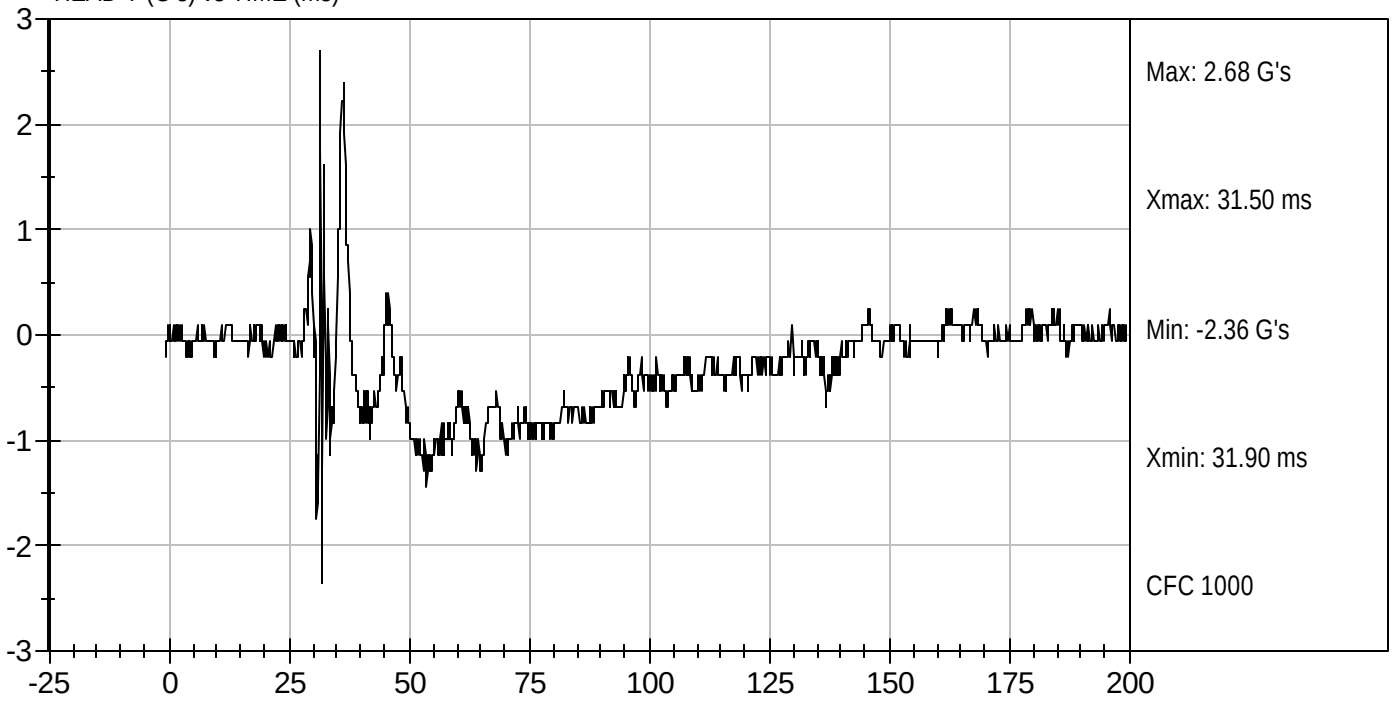
Test Desc: Head Drop
Componet ID: D063321

Test Date: 11/17/2006
Velocity: 0 ft/s, 0.00 m/s

HEAD RESULTANT ACCELERATION (G'S) vs TIME (ms)



HEAD Y (G's) vs TIME (ms)



MGA RESEARCH CORPORATION

NECK FLEXION TEST

HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 066 **Test I.D:** D063322

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	21.3	Pass
Laboratory Relative Humidity		%	10 to 70	21	Pass
Pendulum Velocity		m/s	6.89 to 7.13	7.01	Pass
Pendulum Deceleration	10 msec	G's	22.50 to 27.50	22.82	Pass
	20 msec	G's	17.60 to 22.60	18.11	Pass
	30 msec	G's	12.50 to 18.50	14.69	Pass
Peak Pendulum Deceleration After 30 msec		G's	<= 29.0	14.64	Pass
Deceleration Decay Time to Cross 5 G's		msec	34.0 to 42.0	40.9	Pass
Maximum "D" Plane Rotation	Maximum	Degrees	64.0 to 78.0	71.9	Pass
	Time	msec	57.0 to 64.0	60.0	Pass
"D" Plane Rotation Decay Time To Zero Crossing		msec	113.0 to 128.0	114.5	Pass
Moment About Occipital Condyle	Maximum	N m	88.1 to 108.5	92.1	Pass
	Time	msec	47.0 to 58.0	54.4	Pass
Positive Moment Decay Time To Zero Crossing		msec	97.0 to 107.0	103.2	Pass
			Overall Test Results		Pass

Tim Brady
Laboratory Technician

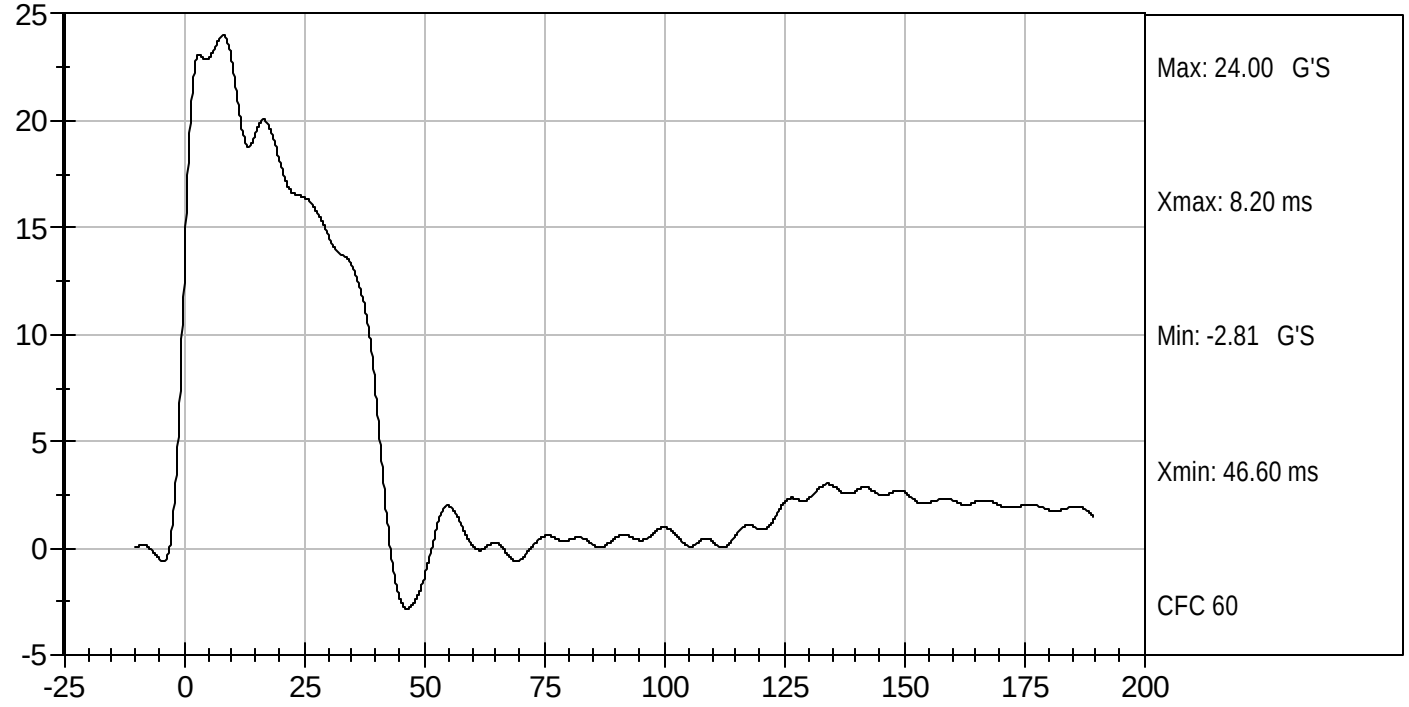
11/20/2006
Test Date

David Winkelbauer
Approved By

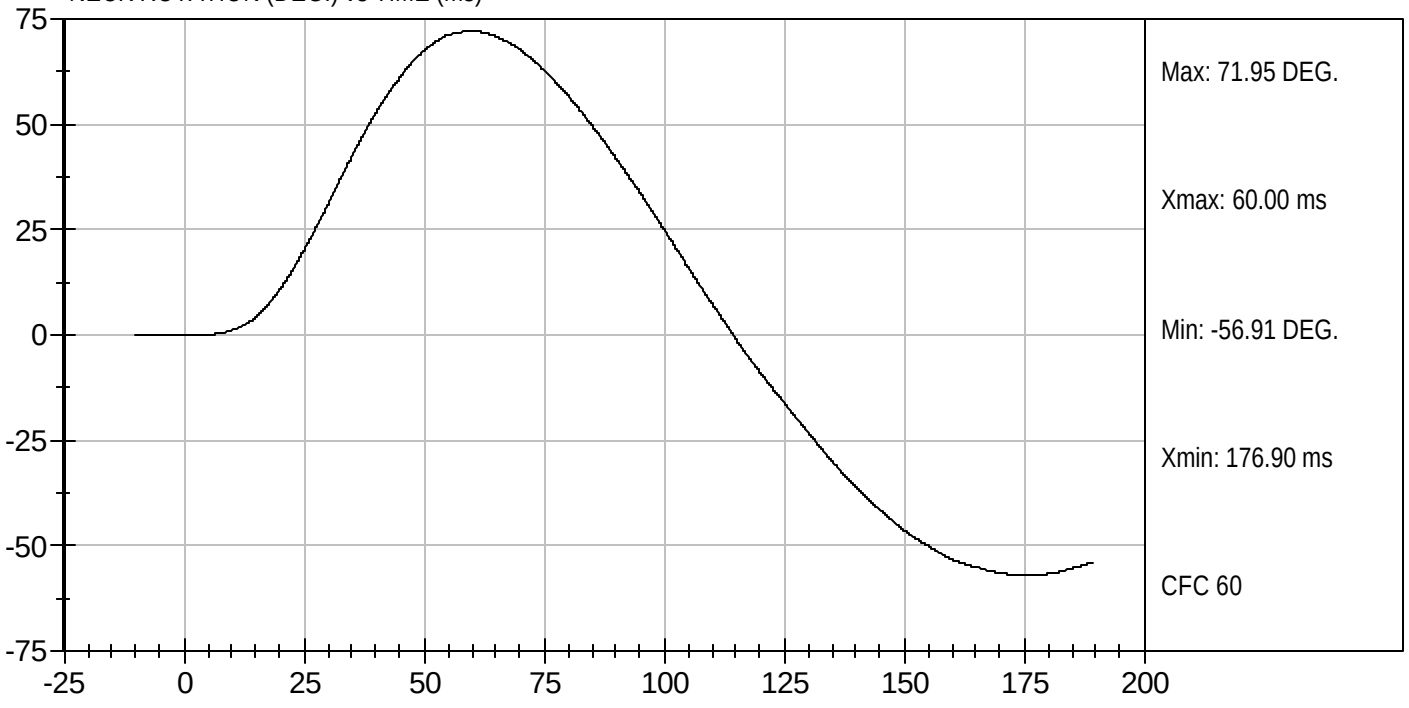
Test Desc: Neck Flexion
Componet ID: D063322

Test Date: 11/20/2006
Velocity: 22.99 ft/s, 7.01 m/s

PENDULUM DECELERATION (G'S) vs TIME (ms)

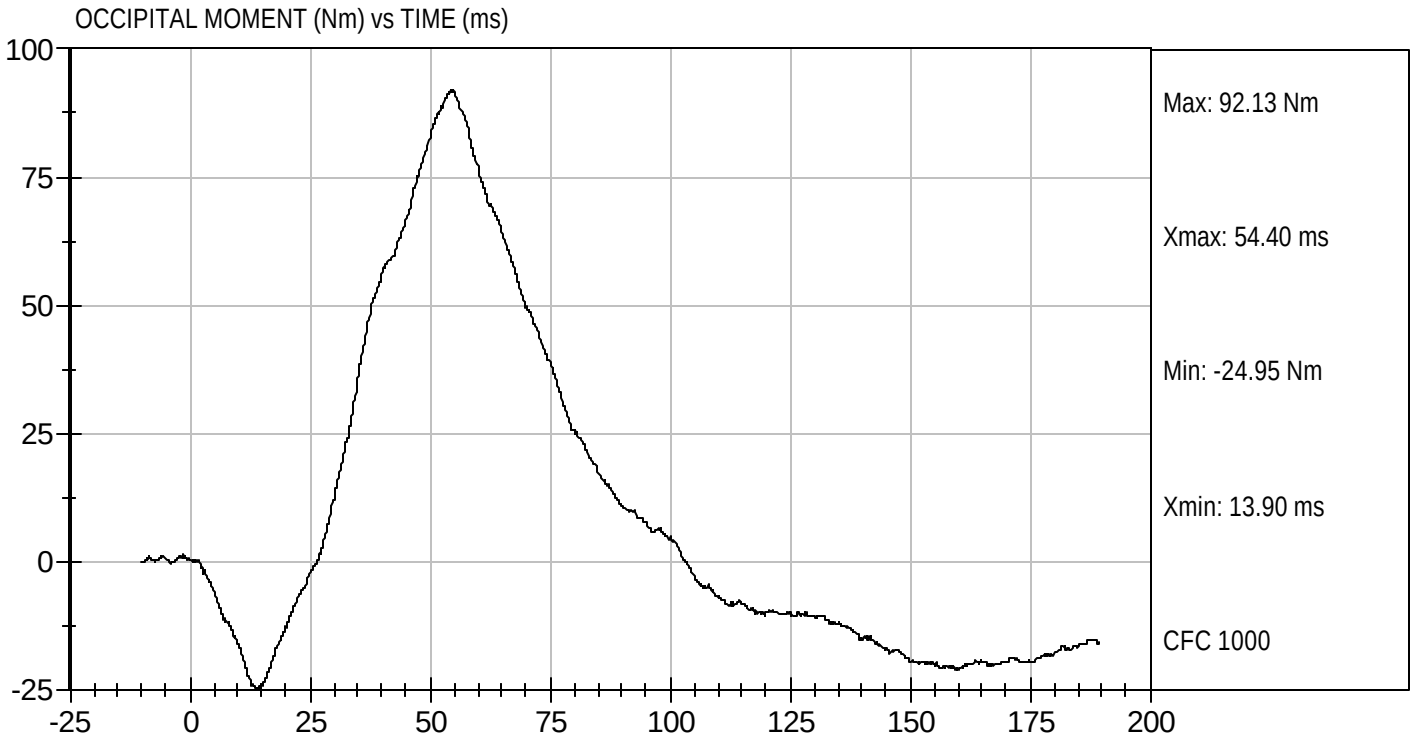


NECK ROTATION (DEG.) vs TIME (ms)



Test Desc: Neck Flexion
Componet ID: D063322

Test Date: 11/20/2006
Velocity: 22.99 ft/s, 7.01 m/s



MGA RESEARCH CORPORATION

NECK EXTENSION TEST

HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 066 **Test I.D:** D063323

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	21.3	Pass
Laboratory Relative Humidity		%	10 to 70	21	Pass
Pendulum Velocity		m/s	5.95 to 6.19	6.07	Pass
Pendulum Deceleration	10 msec	G's	17.20 to 21.20	17.33	Pass
	20 msec	G's	14.00 to 19.00	15.96	Pass
	30 msec	G's	11.00 to 16.00	13.17	Pass
Peak Pendulum Deceleration After 30 msec		G's	<= 22.0	13.16	Pass
Deceleration Decay Time to Cross 5 G's		msec	38.0 to 46.0	42.0	Pass
Maximum "D" Plane Rotation	Maximum	Degrees	81.0 to 106.0	101.3	Pass
	Time	msec	72.0 to 82.0	78.6	Pass
"D" Plane Rotation Decay Time To Zero Crossing		msec	147.0 to 174.0	157.6	Pass
Moment About Occipital Condyle	Maximum	N m	-52.9 to -79.9	-65.8	Pass
	Time	msec	65.0 to 79.0	74.9	Pass
Negative Moment Decay Time To Zero Crossing		msec	120.0 to 148.0	147.2	Pass
			Overall Test Results		Pass

Laboratory Technician

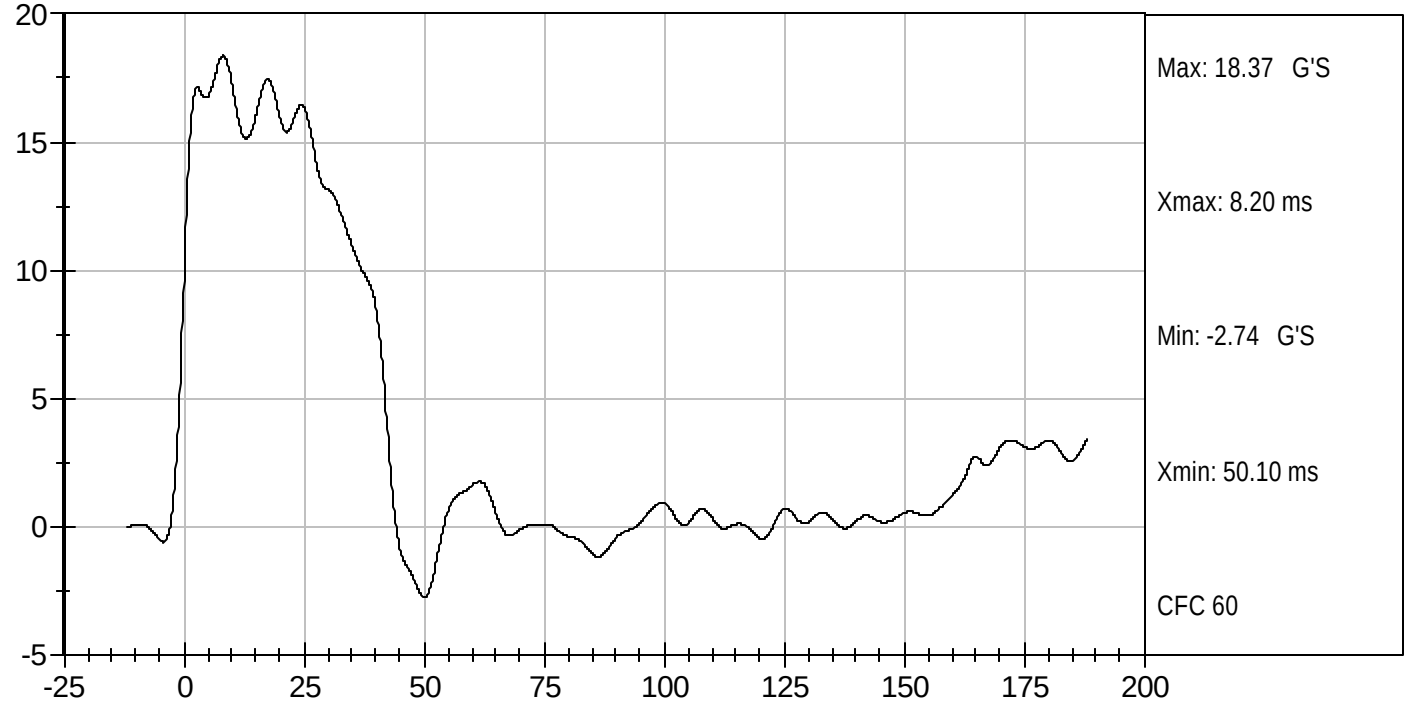
11/20/2006
Test Date

Approved By

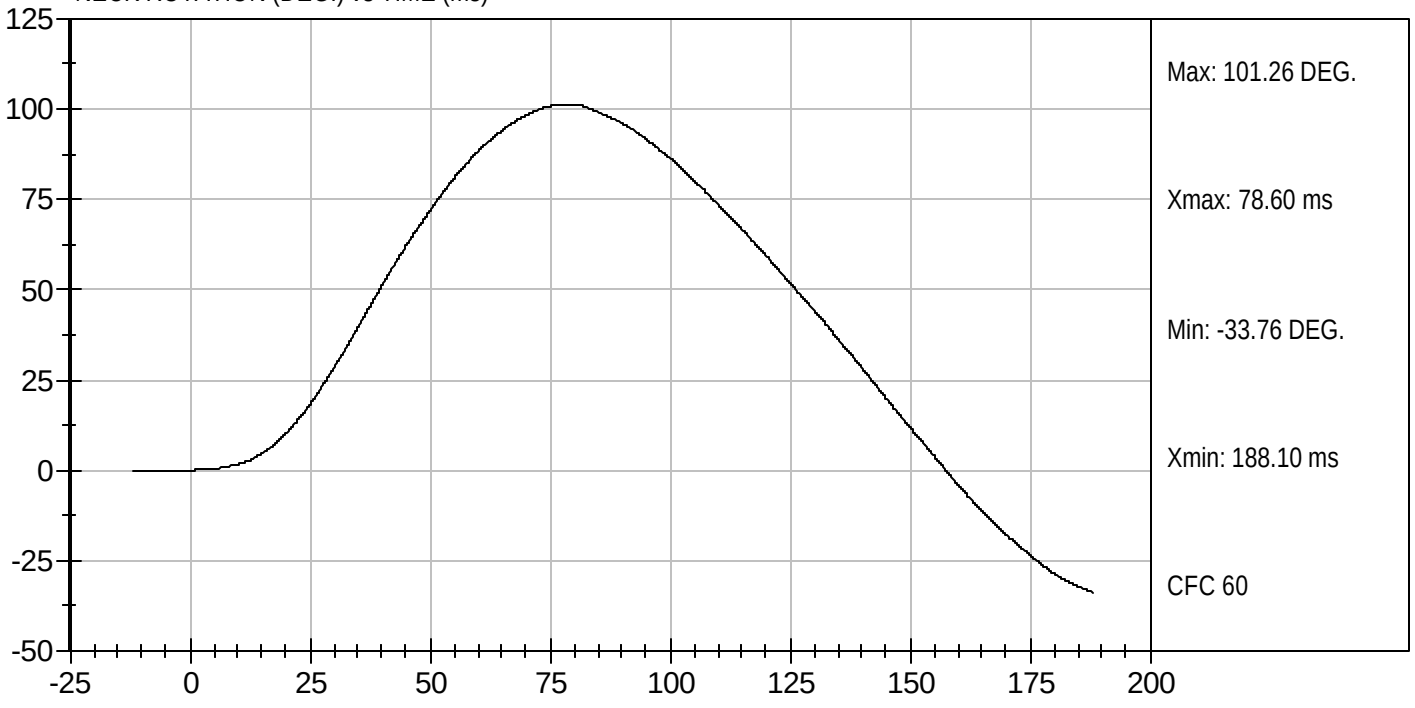
Test Desc: Neck Extension
Componet ID: D063323

Test Date: 11/20/2006
Velocity: 19.91 ft/s, 6.07 m/s

PENDULUM DECELERATION (G'S) vs TIME (ms)



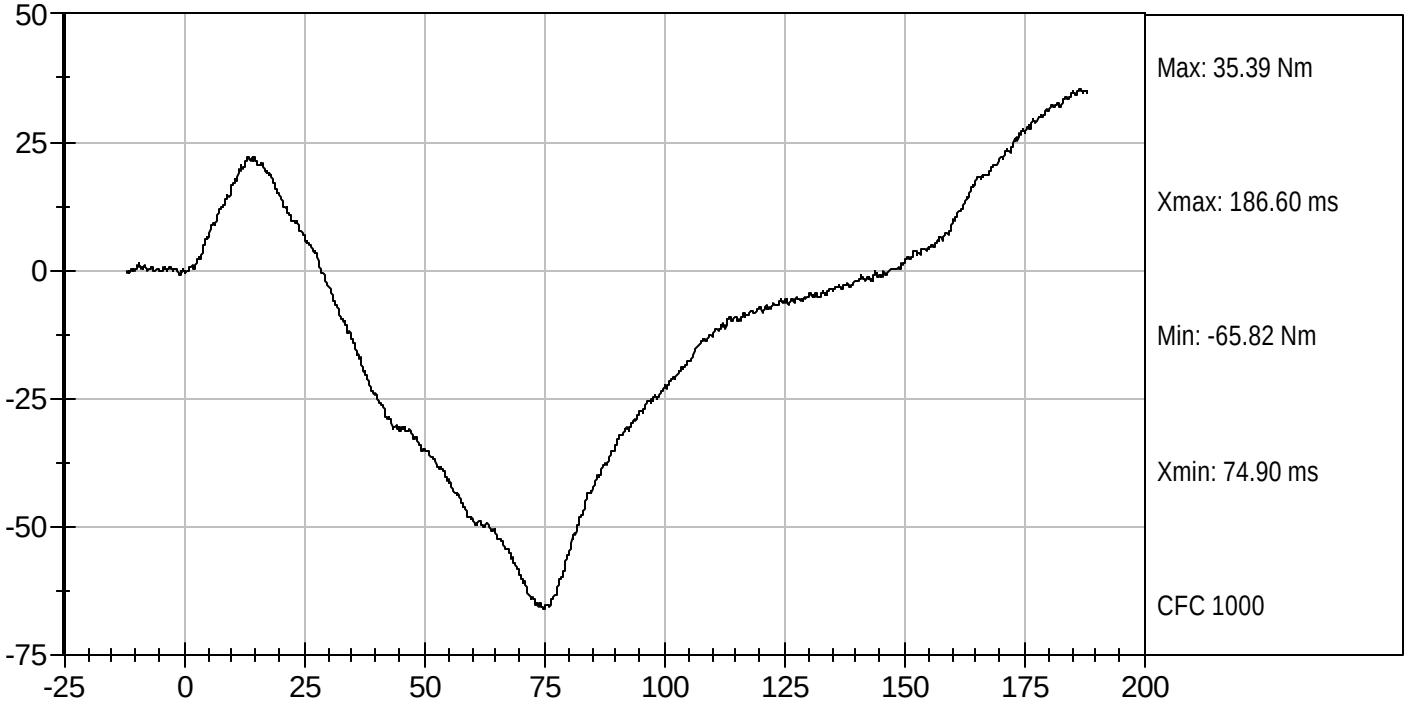
NECK ROTATION (DEG.) vs TIME (ms)



Test Desc: Neck Extension
Componet ID: D063323

Test Date: 11/20/2006
Velocity: 19.91 ft/s, 6.07 m/s

OCCIPITAL MOMENT (Nm) vs TIME (ms)



MGA RESEARCH CORPORATION

THORAX IMPACT

HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 066 **Test I.D:** D063324

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	20.6 to 22.2	21.6	Pass
Laboratory Relative Humidity	%	10 to 70	24	Pass
Probe Velocity	m/s	6.58 to 6.82	6.66	Pass
Peak Probe Force	N	5159 to 5893	5,692	Pass
Peak Sternum Displacement	cm	6.35 to 7.26	6.99	Pass
Internal Hysteresis	%	69 to 85	69	Pass
		Overall Test Results		Pass

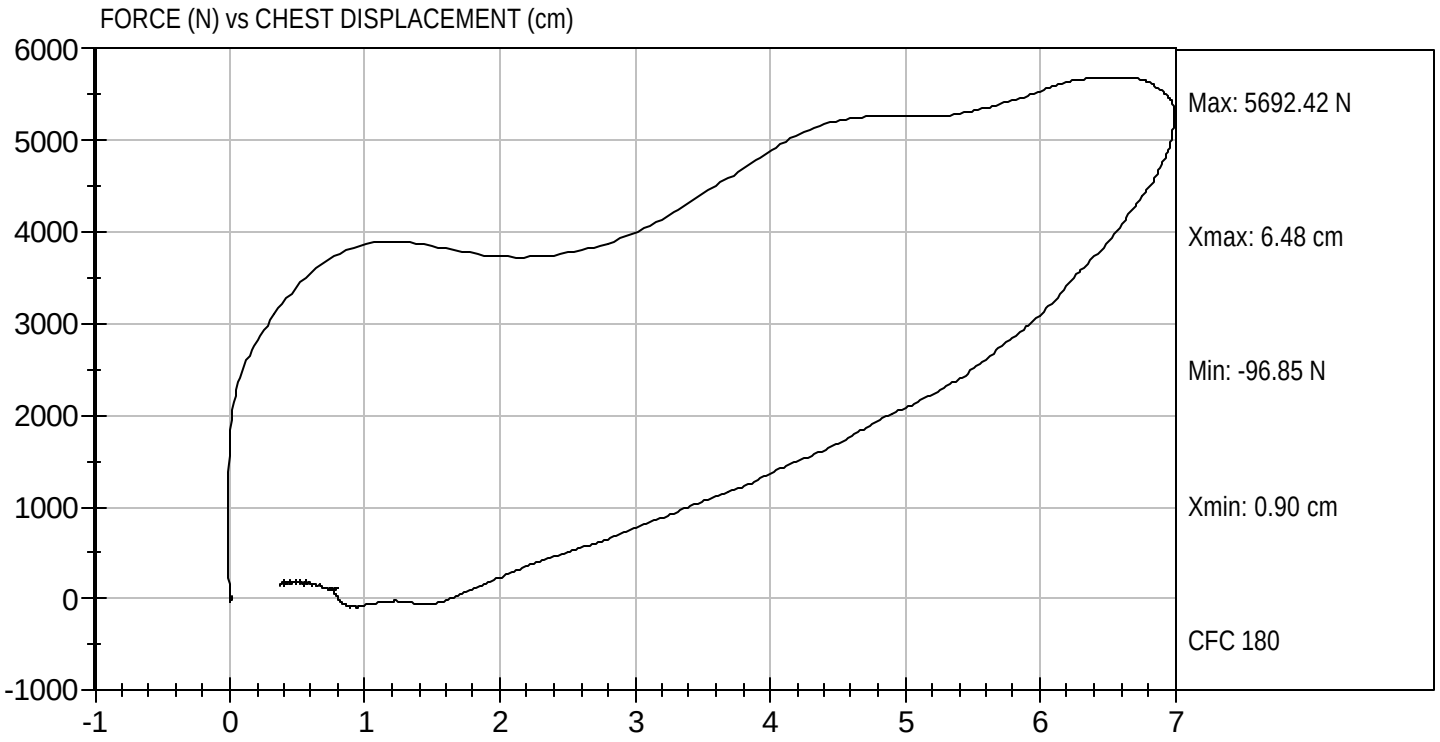
Laboratory Technician

11/17/2006
Test Date

David Winkelbauer
Approved By

Test Desc: Thorax Impact
Componet ID: D063324

Test Date: 11/17/2006
Velocity: 21.86 ft/s, 6.66 m/s



MGA RESEARCH CORPORATION

RIGHT KNEE IMPACT TEST

HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 066 **Test I.D:** D063325

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.5	21.1	Pass
Laboratory Relative Humidity	%	10 to 70	20	Pass
Probe Velocity	m/sec	2.07 to 2.13	2.09	Pass
Peak Probe Force	Newtons	4715 to 5782	5,463	Pass
		Overall Test Results		Pass

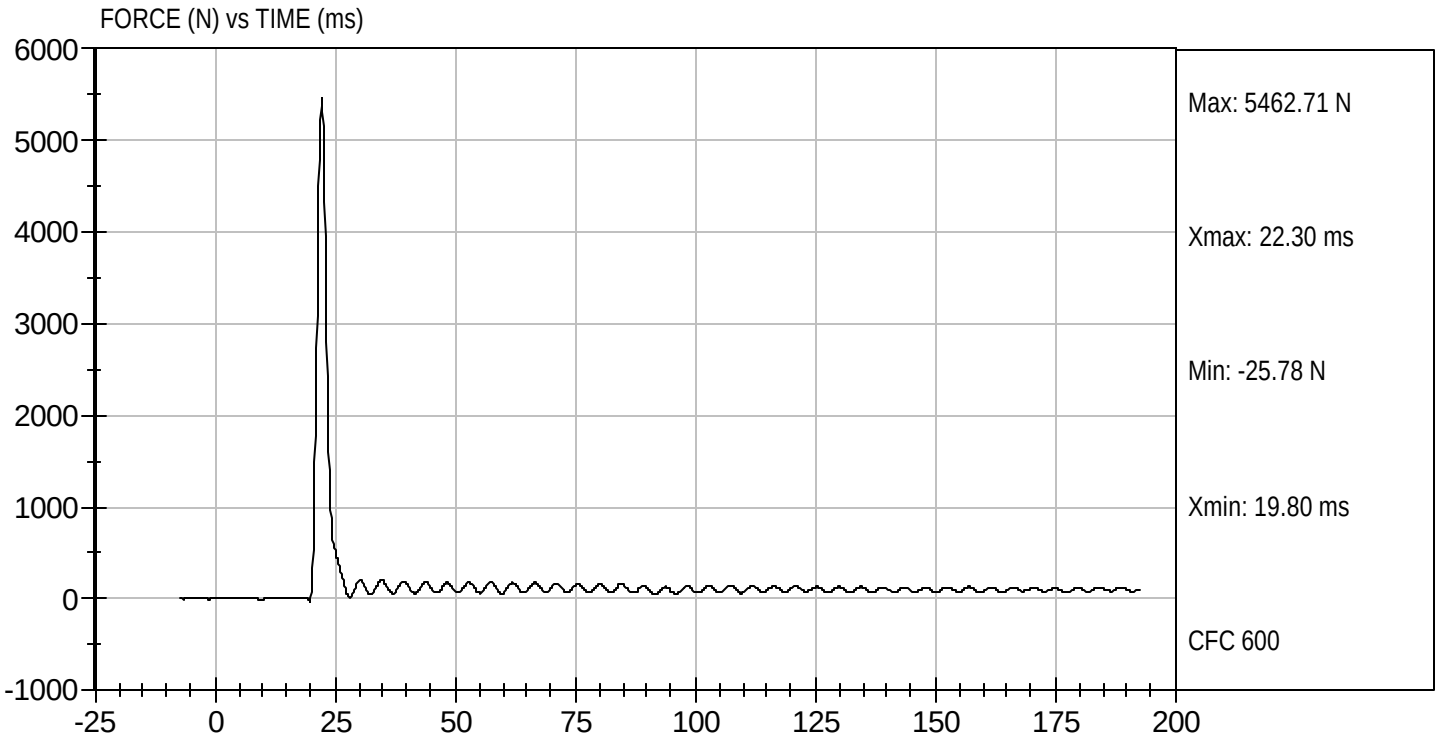
Laboratory Technician

11/20/2006
Test Date

David Winkelbauer
Approved By

Test Desc: Right Knee
Componet ID: D063325

Test Date: 11/20/2006
Velocity: 6.85 ft/s, 2.09 m/s



MGA RESEARCH CORPORATION

LEFT KNEE IMPACT TEST

HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 066 **Test I.D:** D063326

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.5	21.1	Pass
Laboratory Relative Humidity	%	10 to 70	20	Pass
Probe Velocity	m/sec	2.07 to 2.13	2.09	Pass
Peak Probe Force	Newtons	4715 to 5782	5,160	Pass
		Overall Test Results		Pass

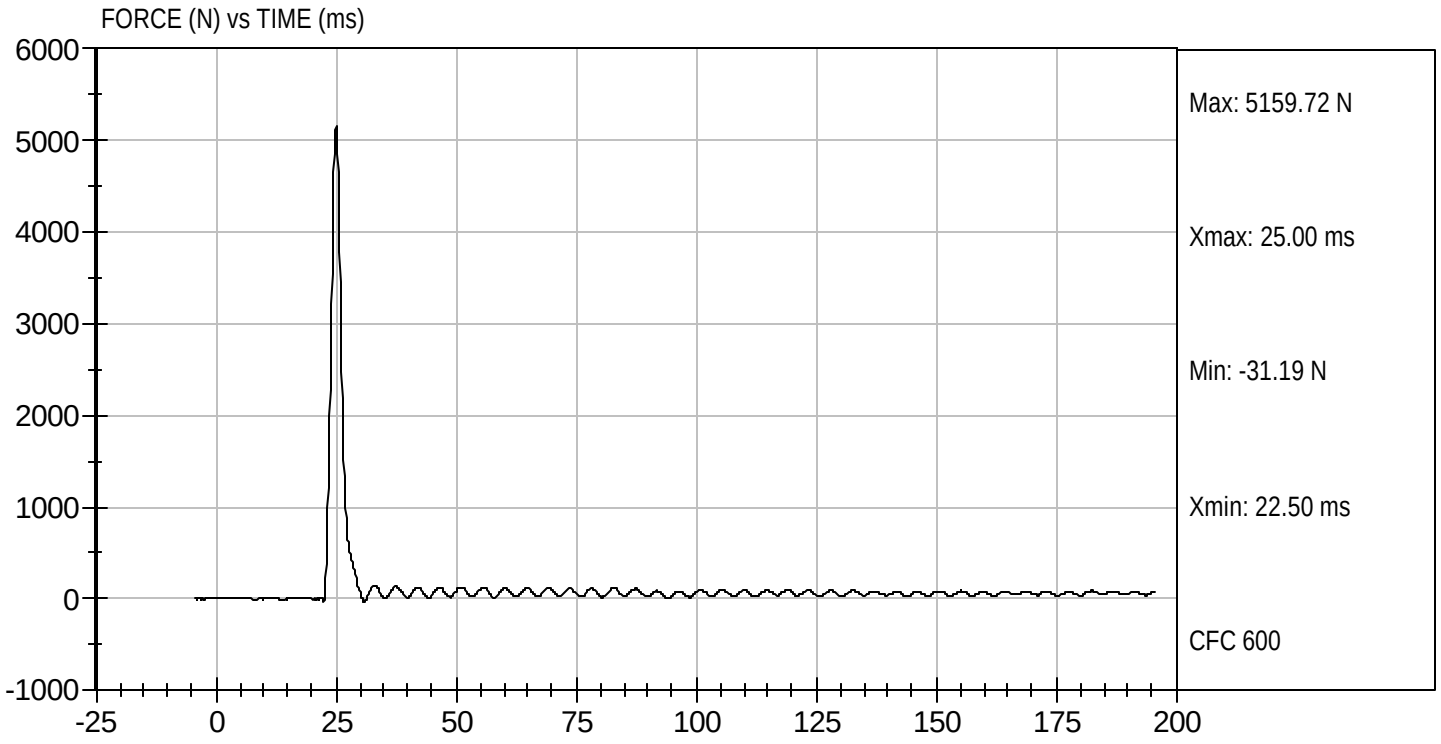
Laboratory Technician

11/20/2006
Test Date

David Winkelbauer
Approved By

Test Desc: Left Knee
Componet ID: D063326

Test Date: 11/20/2006
Velocity: 6.87 ft/s, 2.09 m/s



MGA RESEARCH CORPORATION

HIP-FEMUR FLEXION TEST

HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 066 **Test I.D:** D063320

Tested Parameter	Units	Specification	Result		Pass/Fail
			Right	Left	
Laboratory Temperature	deg C	18.9 to 25.6	21.6	21.6	Pass
Laboratory Relative Humidity	%	10 to 70	25	25	Pass
Rotation Rate	deg/sec	5 -10	8	8	Pass
30 Degrees	Nm	94.9 Nm Max	88.0	84.7	Pass
150 ft-lbf / 203.4 Nm	Deg	40- 50 Degree Max Rotation	43	40	Pass
		Overall Test Results			Pass

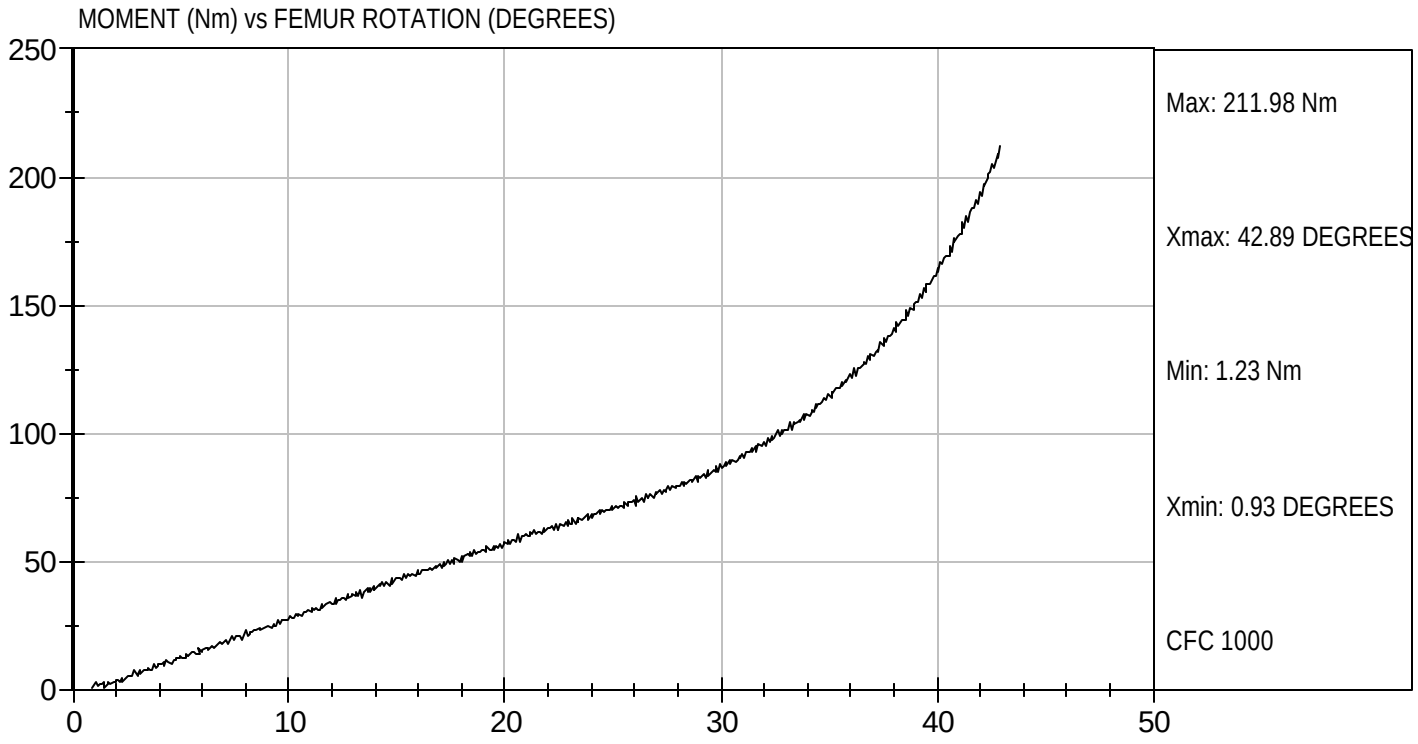
Laboratory Technician

11/17/2006
Test Date

David Winkelbauer
Approved By

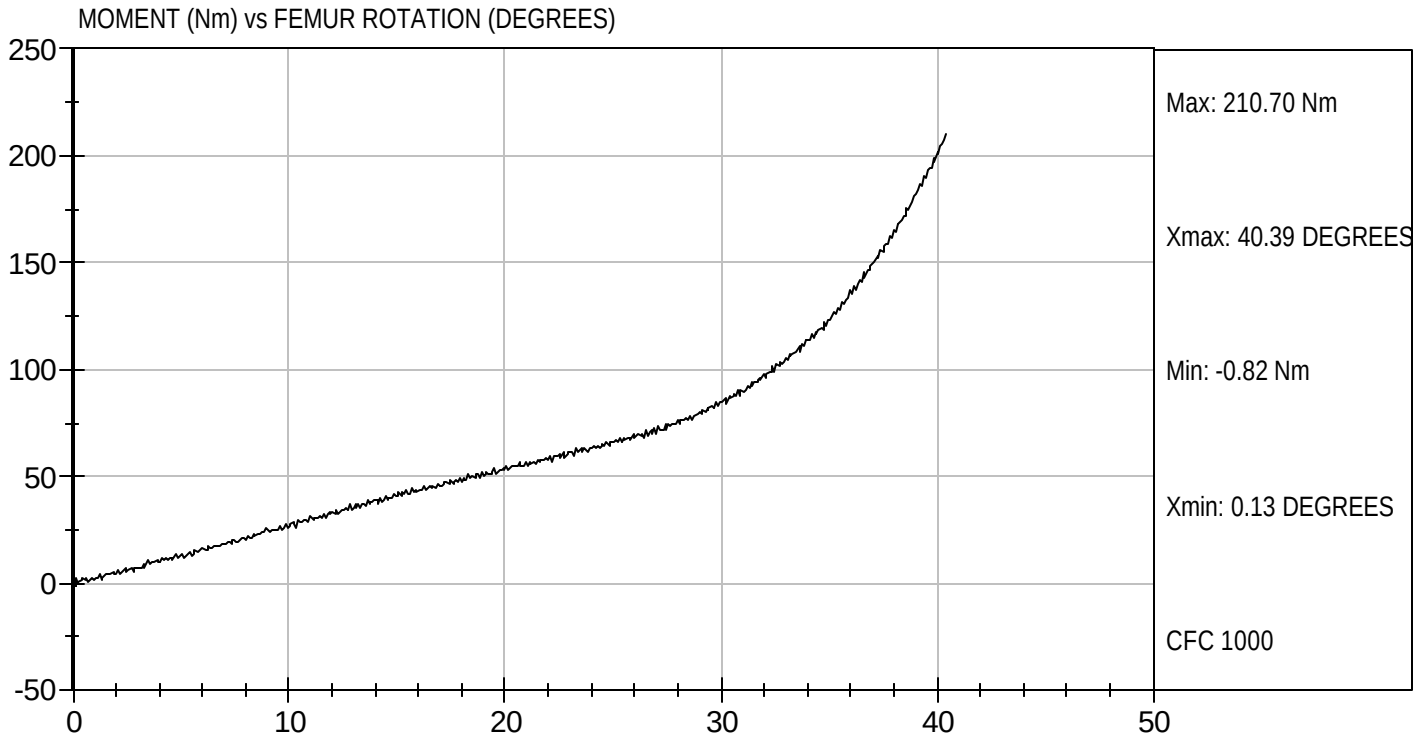
Test Desc: Hip Femur Flexion
Componet ID: D063329

Test Date: 11/17/2006
Velocity: 0 ft/s, 0.00 m/s



Test Desc: Hip Femur Flexion
Componet ID: D063320

Test Date: 11/17/2006
Velocity: 0 ft/s, 0.00 m/s



MGA RESEARCH CORPORATION

HEAD DROP TEST

HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 065 **Test ID:** D063311

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 - 25.6	21.7	Pass
Laboratory Relative Humidity	%	10 to 70	25	Pass
Peak Resultant Acceleration	G's	225 - 275	235	Pass
Peak Lateral Acceleration	G's	<= +/- 15.0	7.5	Pass
Unimodal	N/A	Yes	Yes	Pass
Oscillations	N/A	within 10% of peak	Yes	Pass
		Overall Test Results		Pass

Laboratory Technician

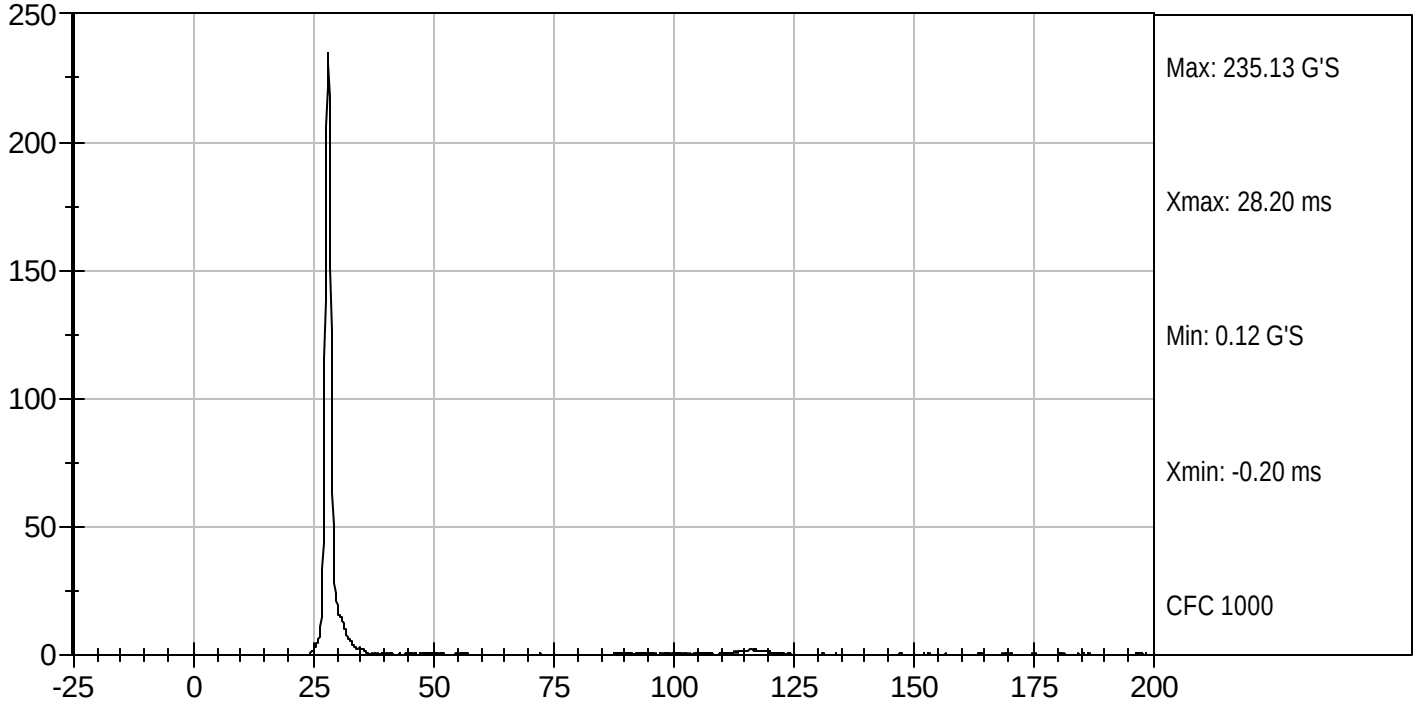
11/17/2006
Test Date

David Winkelbauer
Approved By

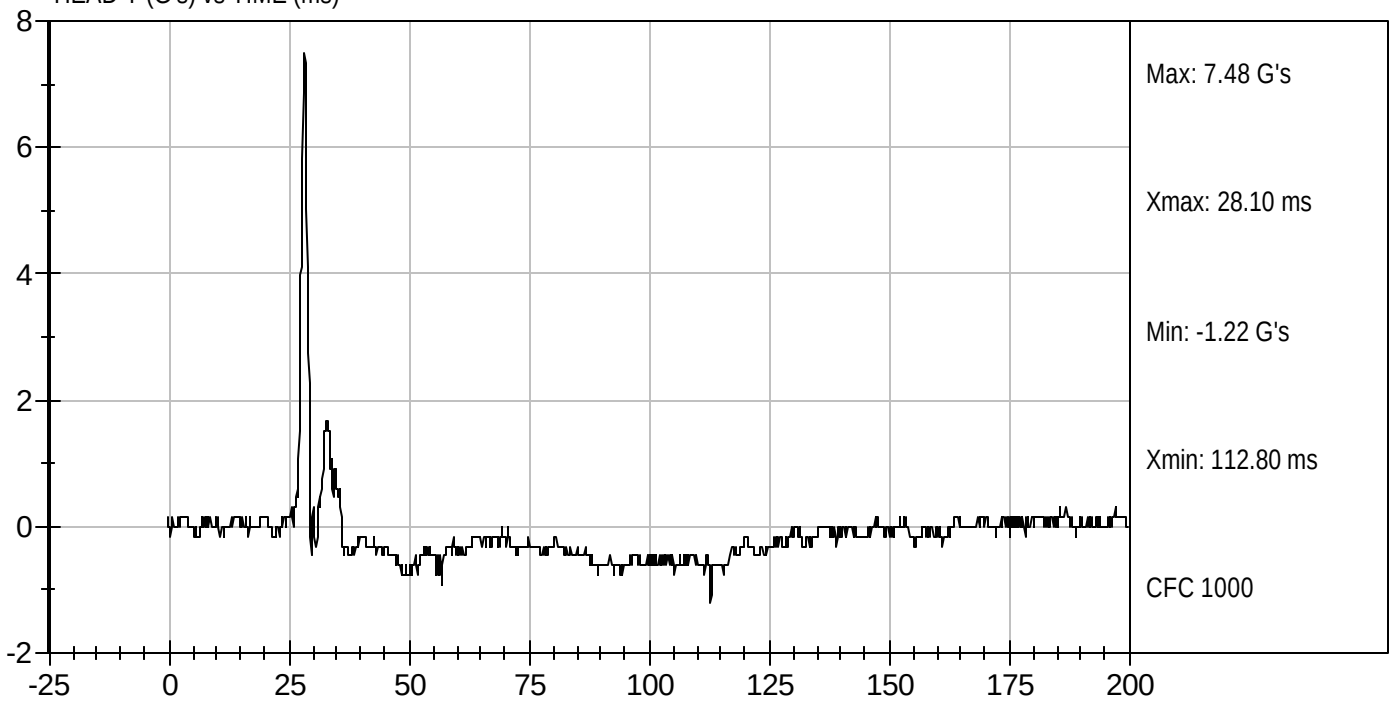
Test Desc: Head Drop
Componet ID: D063311

Test Date: 11/17/2006
Velocity: 0 ft/s, 0.00 m/s

HEAD RESULTANT ACCELERATION (G'S) vs TIME (ms)



HEAD Y (G's) vs TIME (ms)



MGA RESEARCH CORPORATION

NECK FLEXION TEST

HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 065 **Test I.D:** D063312

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	21.2	Pass
Laboratory Relative Humidity		%	10 to 70	20	Pass
Pendulum Velocity		m/s	6.89 to 7.13	7.00	Pass
Pendulum Deceleration	10 msec	G's	22.50 to 27.50	26.27	Pass
	20 msec	G's	17.60 to 22.60	21.01	Pass
	30 msec	G's	12.50 to 18.50	15.14	Pass
Peak Pendulum Deceleration After 30 msec		G's	<= 29.0	15.06	Pass
Deceleration Decay Time to Cross 5 G's		msec	34.0 to 42.0	34.1	Pass
Maximum "D" Plane Rotation	Maximum	Degrees	64.0 to 78.0	76.5	Pass
	Time	msec	57.0 to 64.0	60.2	Pass
"D" Plane Rotation Decay Time To Zero Crossing		msec	113.0 to 128.0	114.7	Pass
Moment About Occipital Condyle	Maximum	N m	88.1 to 108.5	99.5	Pass
	Time	msec	47.0 to 58.0	47.4	Pass
Positive Moment Decay Time To Zero Crossing		msec	97.0 to 107.0	100.8	Pass
			Overall Test Results		Pass

Tim Brady
Laboratory Technician

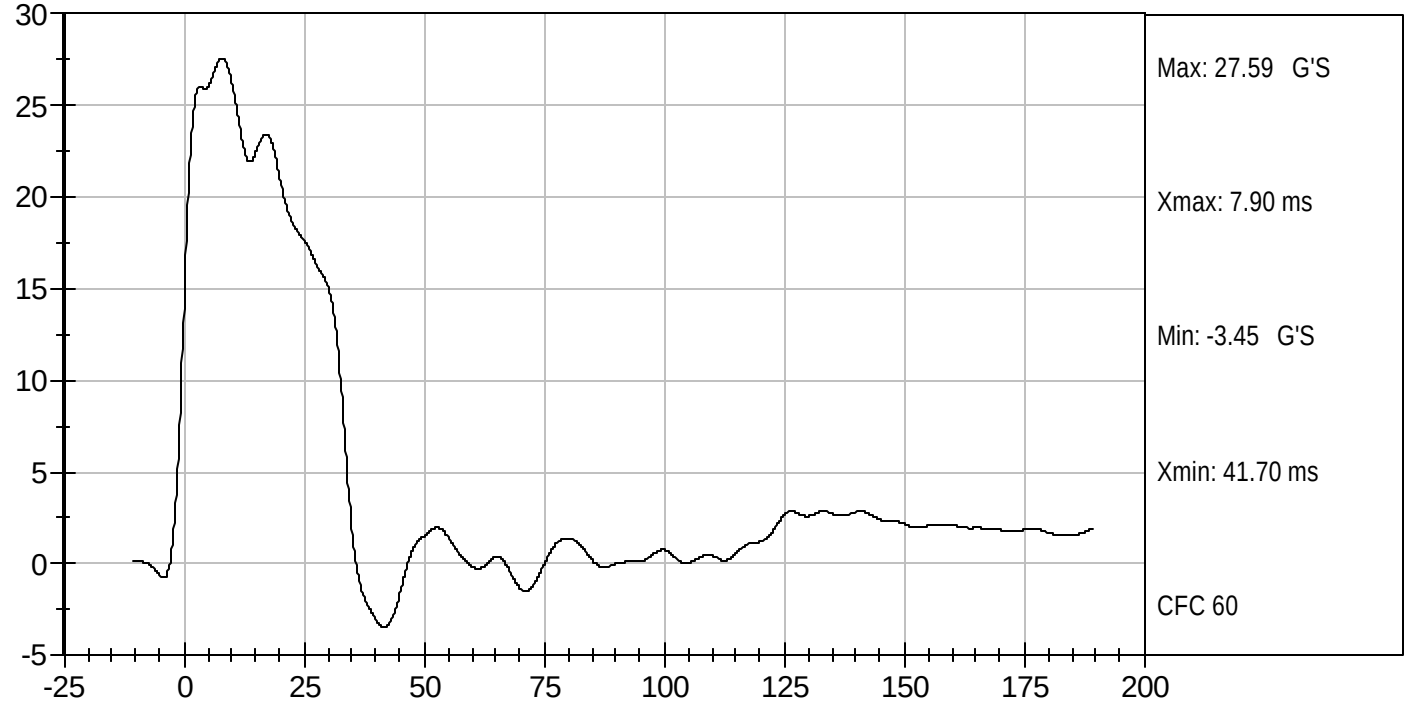
11/20/2006
Test Date

David Winkelbauer
Approved By

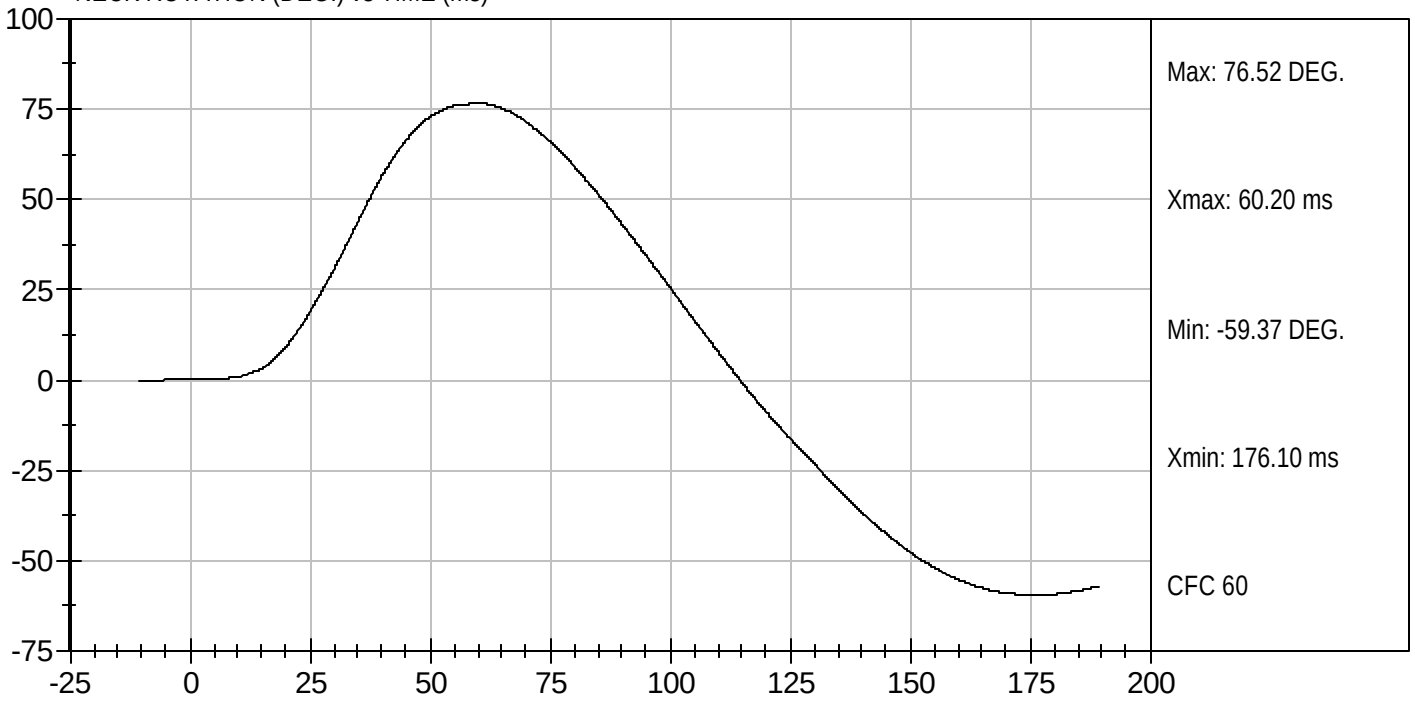
Test Desc: Neck Flexion
Componet ID: D063312

Test Date: 11/20/2006
Velocity: 22.96 ft/s, 7.00 m/s

PENDULUM DECELERATION (G'S) vs TIME (ms)

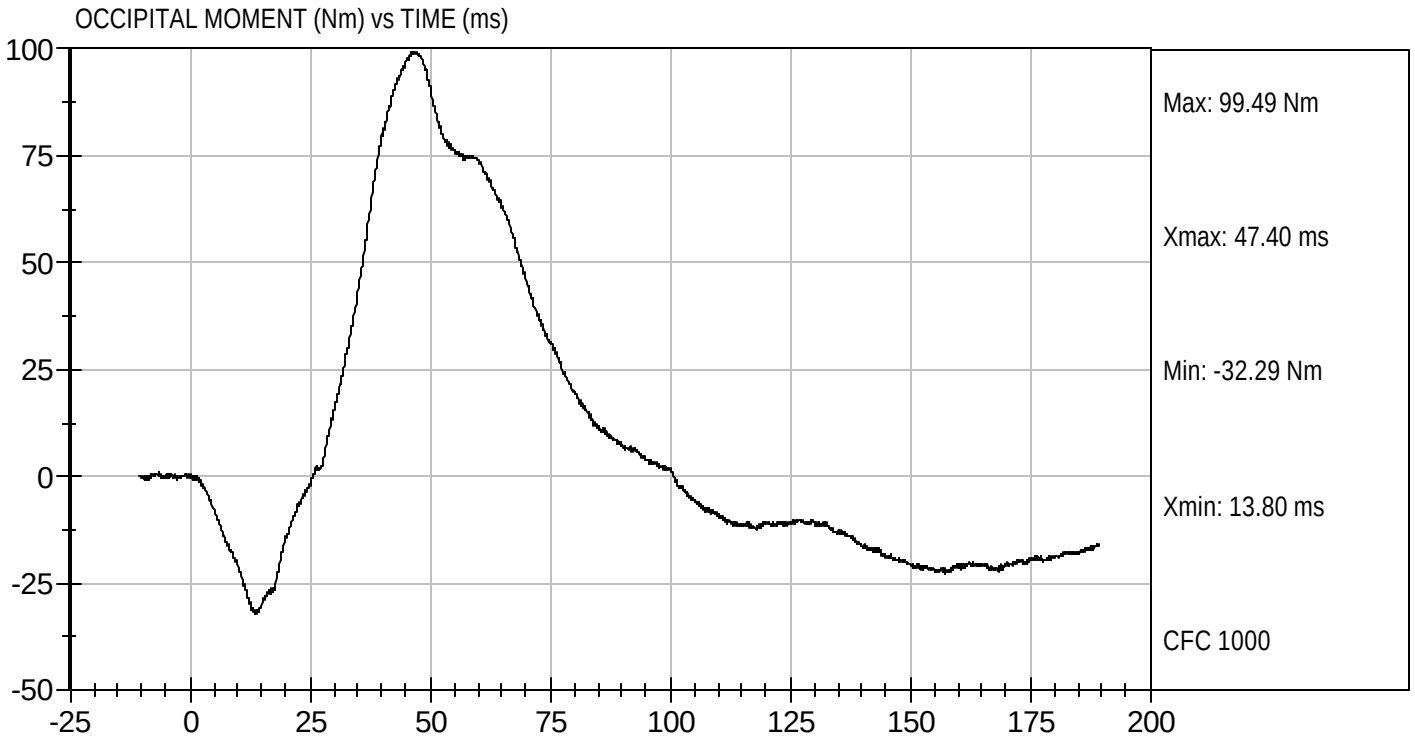


NECK ROTATION (DEG.) vs TIME (ms)



Test Desc: Neck Flexion
Componet ID: D063312

Test Date: 11/20/2006
Velocity: 22.96 ft/s, 7.00 m/s



MGA RESEARCH CORPORATION

NECK EXTENSION TEST

HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 065 **Test I.D:** D063313

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	21.2	Pass
Laboratory Relative Humidity		%	10 to 70	20	Pass
Pendulum Velocity		m/s	5.95 to 6.19	6.08	Pass
Pendulum Deceleration	10 msec	G's	17.20 to 21.20	18.52	Pass
	20 msec	G's	14.00 to 19.00	16.43	Pass
	30 msec	G's	11.00 to 16.00	14.66	Pass
Peak Pendulum Deceleration After 30 msec		G's	<= 22.0	14.89	Pass
Deceleration Decay Time to Cross 5 G's		msec	38.0 to 46.0	39.2	Pass
Maximum "D" Plane Rotation	Maximum	Degrees	81.0 to 106.0	103.1	Pass
	Time	msec	72.0 to 82.0	78.1	Pass
"D" Plane Rotation Decay Time To Zero Crossing		msec	147.0 to 174.0	158.1	Pass
Moment About Occipital Condyle	Maximum	N m	-52.9 to -79.9	-72.0	Pass
	Time	msec	65.0 to 79.0	73.6	Pass
Negative Moment Decay Time To Zero Crossing		msec	120.0 to 148.0	147.1	Pass
			Overall Test Results		Pass

Laboratory Technician

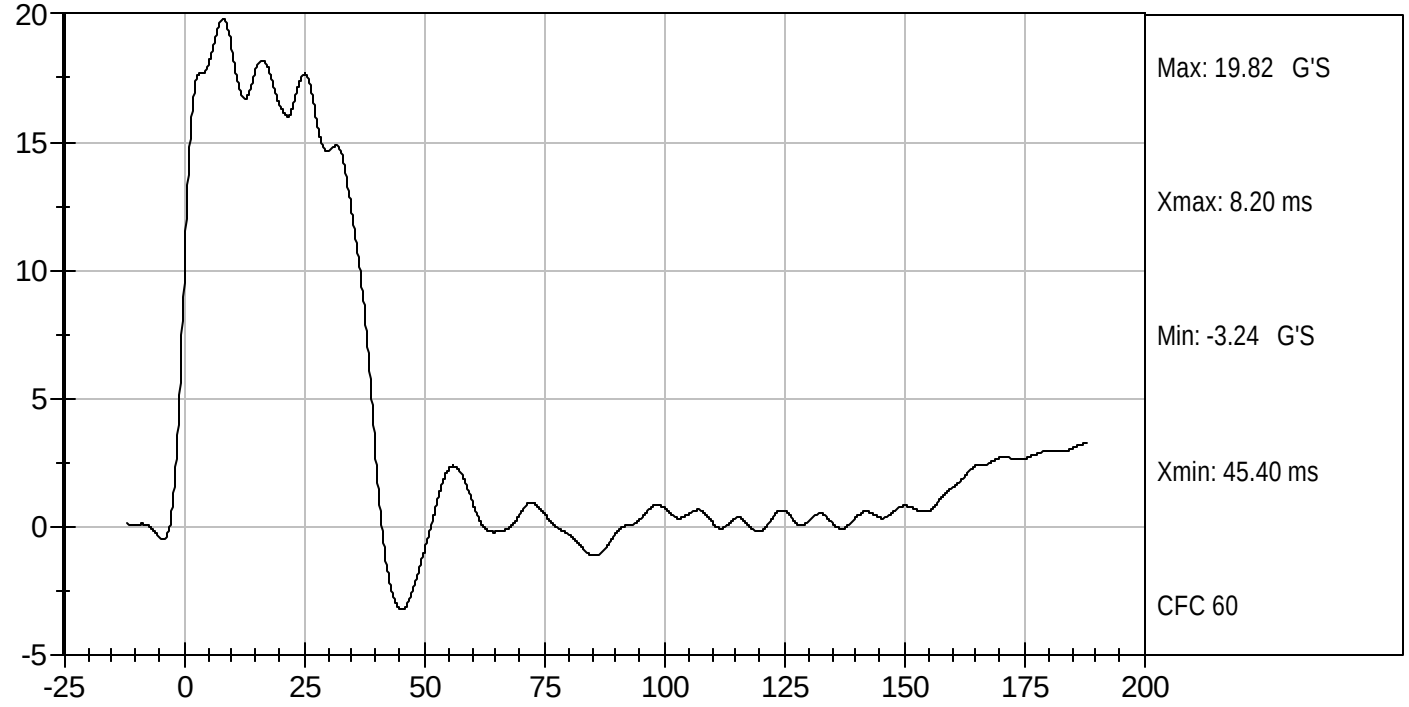
11/20/2006
Test Date

Approved By

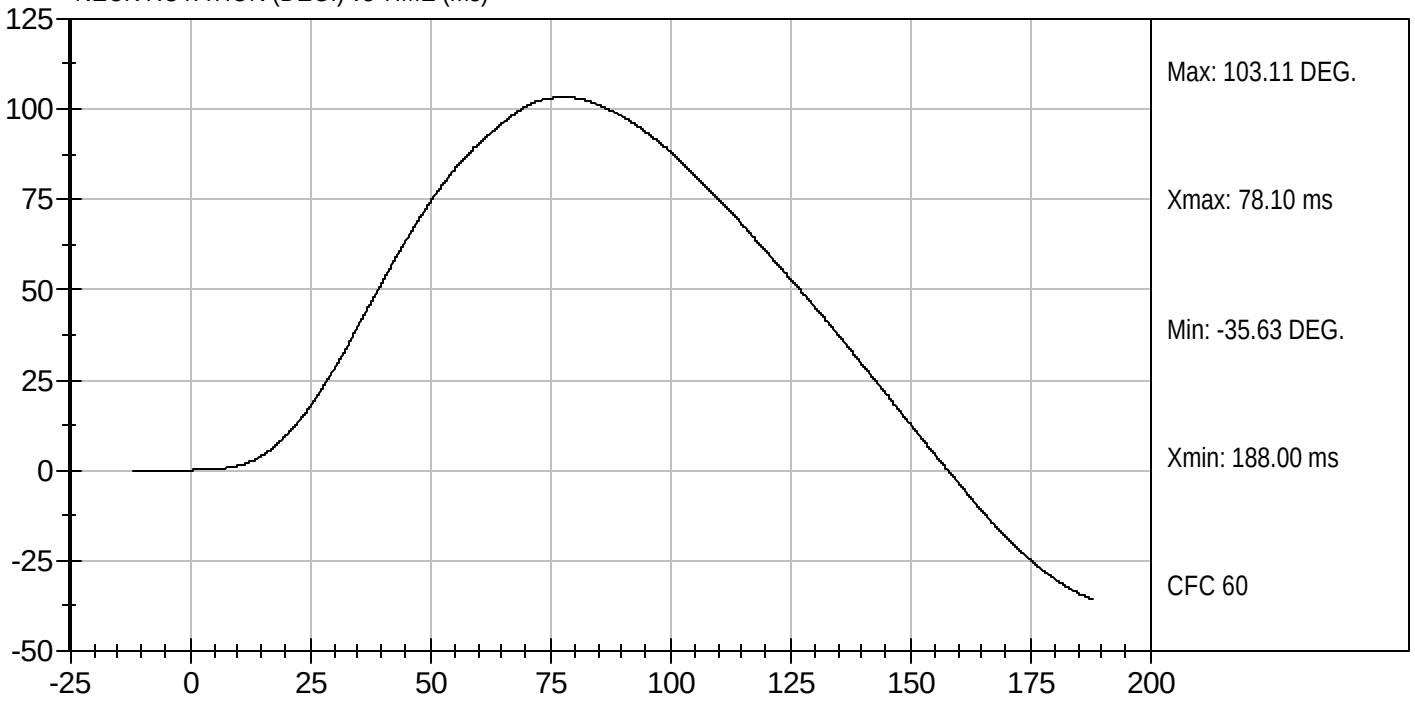
Test Desc: Neck Extension
Componet ID: D063313

Test Date: 11/20/2006
Velocity: 19.94 ft/s, 6.08 m/s

PENDULUM DECELERATION (G'S) vs TIME (ms)

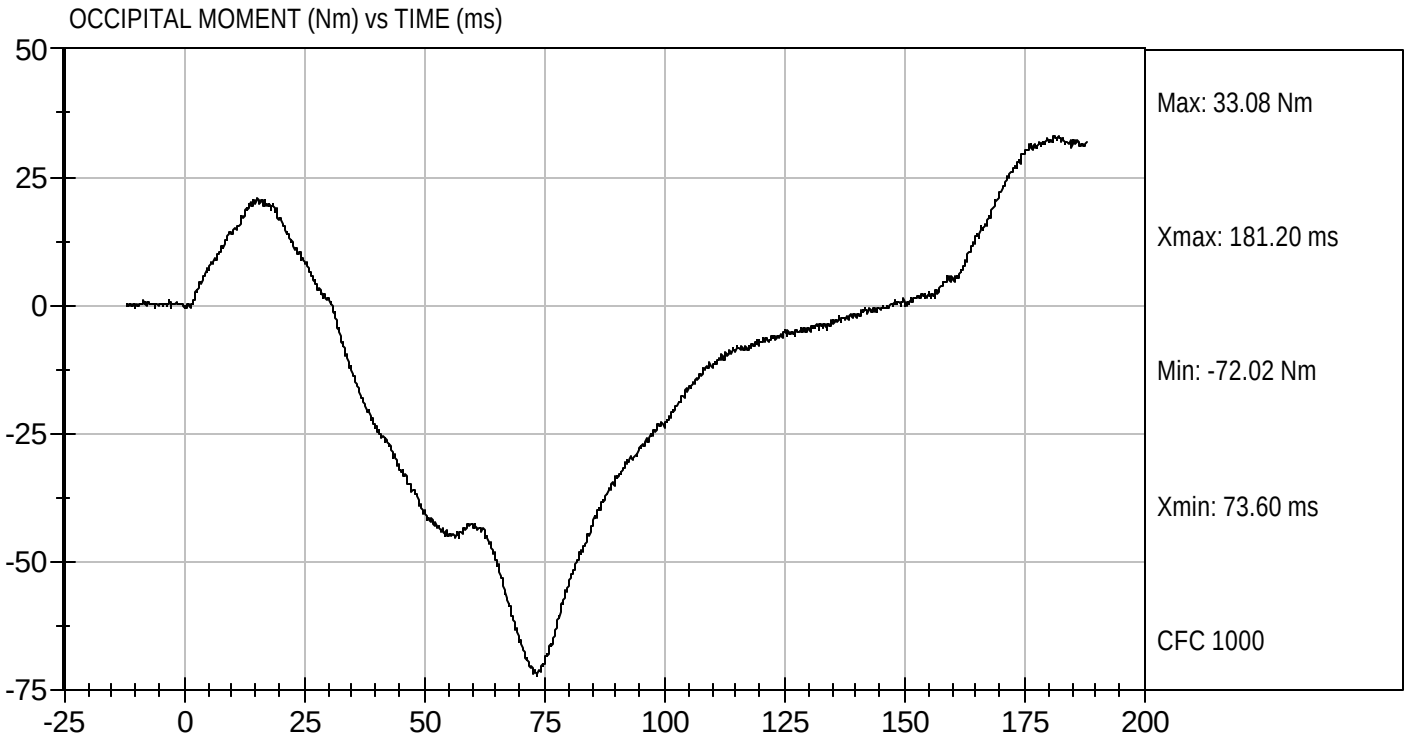


NECK ROTATION (DEG.) vs TIME (ms)



Test Desc: Neck Extension
Componet ID: D063313

Test Date: 11/20/2006
Velocity: 19.94 ft/s, 6.08 m/s



MGA RESEARCH CORPORATION

THORAX IMPACT

HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 065 **Test I.D:** D063314

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	20.6 to 22.2	21.7	Pass
Laboratory Relative Humidity	%	10 to 70	24	Pass
Probe Velocity	m/s	6.58 to 6.82	6.65	Pass
Peak Probe Force	N	5159 to 5893	5,826	Pass
Peak Sternum Displacement	cm	6.35 to 7.26	6.73	Pass
Internal Hysteresis	%	69 to 85	70	Pass
		Overall Test Results		Pass

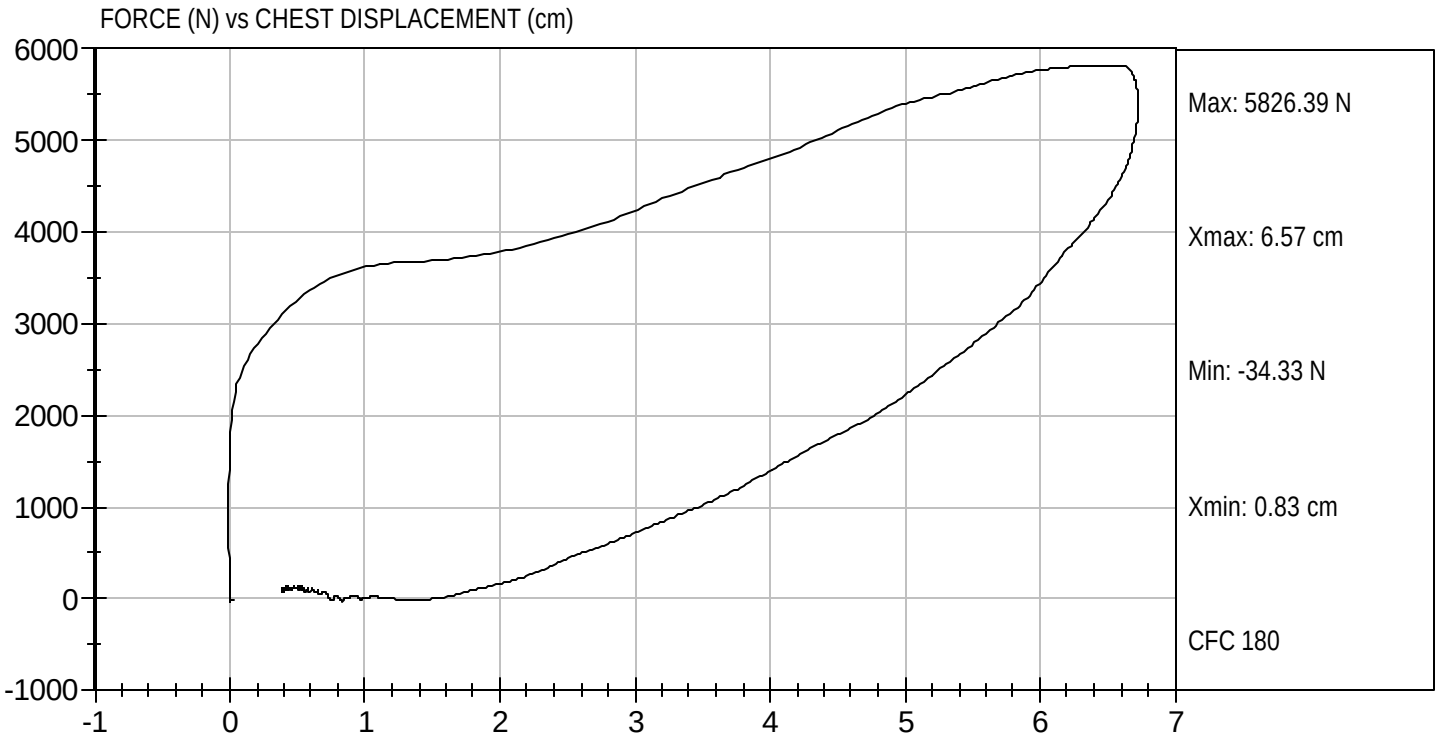
Laboratory Technician

11/17/2006
Test Date

David Winkelbauer
Approved By

Test Desc: Thorax Impact
Componet ID: D063314

Test Date: 11/17/2006
Velocity: 21.82 ft/s, 6.65 m/s



MGA RESEARCH CORPORATION

RIGHT KNEE IMPACT TEST

HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 065 **Test I.D:** D063315

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.5	21.2	Pass
Laboratory Relative Humidity	%	10 to 70	20	Pass
Probe Velocity	m/sec	2.07 to 2.13	2.11	Pass
Peak Probe Force	Newtons	4715 to 5782	5,238	Pass
		Overall Test Results		Pass

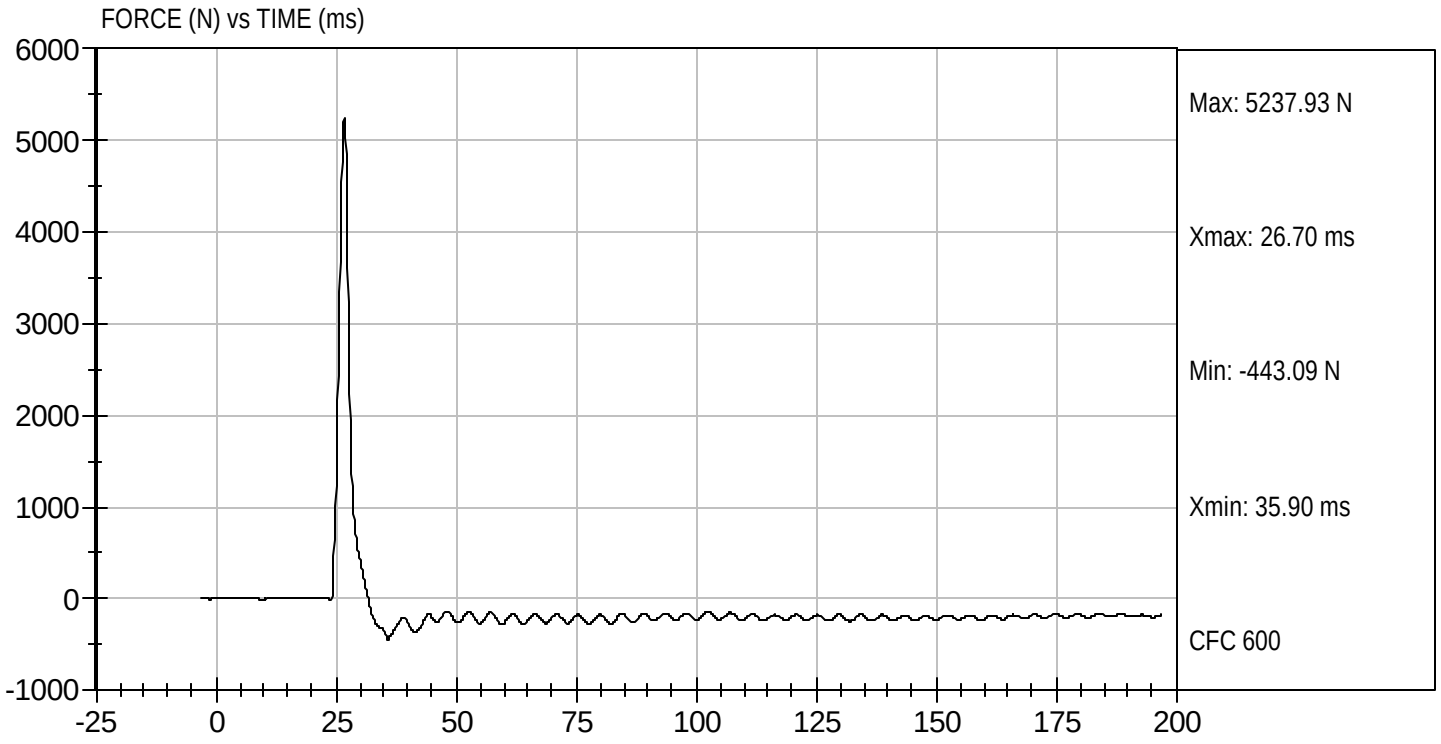
Laboratory Technician

11/20/2006
Test Date

David Winkelbauer
Approved By

Test Desc: Right Knee
Componet ID: D063315

Test Date: 11/20/2006
Velocity: 6.92 ft/s, 2.11 m/s



MGA RESEARCH CORPORATION

LEFT KNEE IMPACT TEST

HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 065 **Test I.D:** D063316

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.5	21.2	Pass
Laboratory Relative Humidity	%	10 to 70	20	Pass
Probe Velocity	m/sec	2.07 to 2.13	2.10	Pass
Peak Probe Force	Newtons	4715 to 5782	5,558	Pass
		Overall Test Results		Pass

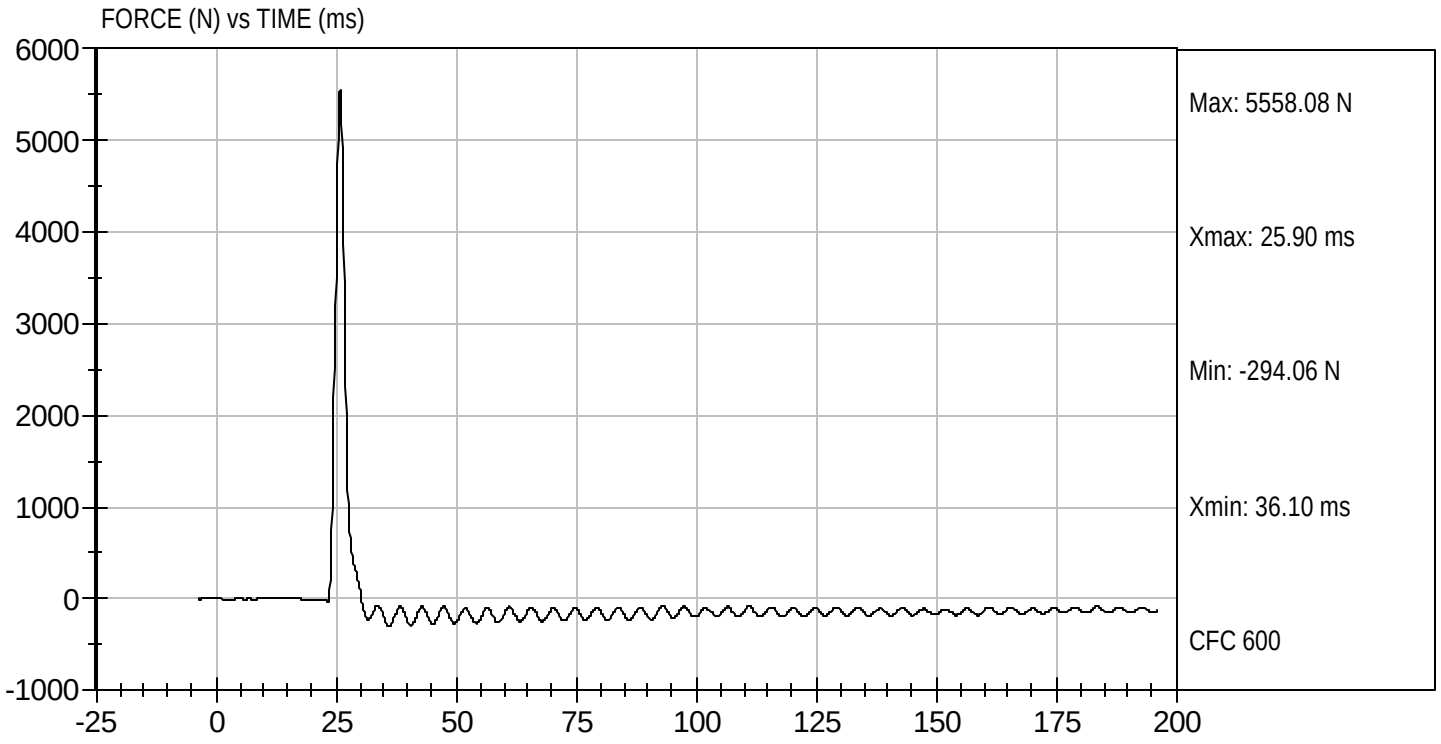
Laboratory Technician

11/20/2006
Test Date

David Winkelbauer
Approved By

Test Desc: Left Knee
Componet ID: D063316

Test Date: 11/20/2006
Velocity: 6.88 ft/s, 2.10 m/s



MGA RESEARCH CORPORATION

HIP-FEMUR FLEXION TEST

HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 065 **Test I.D:** D063310

Tested Parameter	Units	Specification	Result		Pass/Fail
			Right	Left	
Laboratory Temperature	deg C	18.9 to 25.6	21.8	21.8	Pass
Laboratory Relative Humidity	%	10 to 70	25	25	Pass
Rotation Rate	deg/sec	5 -10	8	8	Pass
30 Degrees	Nm	94.9 Nm Max	92.1	83.9	Pass
150 ft-lbf / 203.4 Nm	Deg	40- 50 Degree Max Rotation	42	41	Pass
		Overall Test Results			Pass

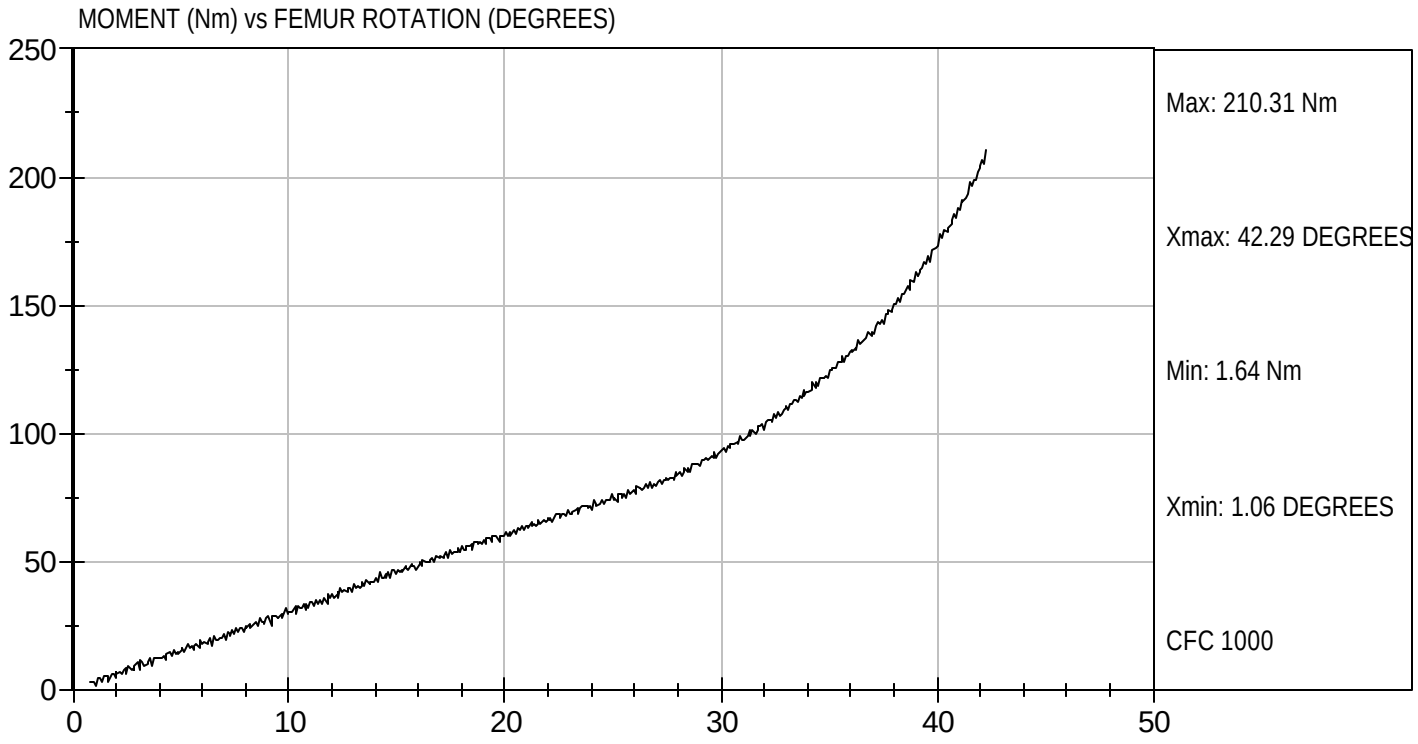
Laboratory Technician

11/17/2006
Test Date

David Winkelbauer
Approved By

Test Desc: Hip Femur Flexion
Componet ID: D063319

Test Date: 11/17/2006
Velocity: 0 ft/s, 0.00 m/s



Test Desc: Hip Femur Flexion
Componet ID: D063310

Test Date: 11/17/2006
Velocity: 0 ft/s, 0.00 m/s